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The AUTOMOBILE

Prefer Small Car to Cyclecar

Britisher Likes the Miniature Car, But Belt-Driven and Friction-Type Cyclecars Gain in Favor—Few Monocars—Three-Wheelers Are Few—London's Show Huge Success

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President Institution of Automobile Engineers

LONDON, Dec. 6—Though the very large representative show now being held at Olympia contains within its doors a considerable number of cycles and motorcycles, it is beyond doubt the cyclecar and light car that are responsible for the great number of visitors that have filled the building during most of the time that the doors have been open to the public. There is no doubt that the present year is the first one during which much attention has been paid by manufacturers to the latest and lightest form of car—the cyclecar, and a number of these little vehicles varying much in design are to be seen.

In actual figures there are thirty-three cyclecar exhibits, the lowest in price being in the neighborhood of $300, and these small cars contain within their anatomy or that part of their anatomy which has to do with transmission—belt drive, chain drive, gear drive and friction drive. There are a number of cars employing a final belt drive and the modern type of belt gives no doubt a very satisfactory drive, and does not cause an unreasonable amount of wear in the bearings, which are subjected to the pull of the belt.

The so-called cyclecar must at the present time be considered to be in a transition state. The difference between a cyclecar and a light car is practically a matter of weight, any chassis scaling over 672 pounds being allocated to the car class.

The Cyclecar Weight Limit

Thus it is that all vehicles exhibited at the Fourth International Exhibition organized by the Cycle and Motorcycle Traders' Union, Limited, are of a chassis weight not exceeding 672 pounds.

The term cyclecar is not a very appropriate one, for many of the cars of this class are really large cars in miniature and have nothing in common with that class of work one usually associates with motorcycle construction.

The original cyclecar started out with a single or twin air-cooled engine and belt drive, but today the art has so far progressed that within the set weight it is possible to construct such cars with a four-cylinder, water-cooled engine 60 millimeters bore by 100 millimeters stroke, a three-speed gearbox and a worm-driven back axle, steel detachable wheels, in fact a car in all respects similar to the modern high-powered car in design.

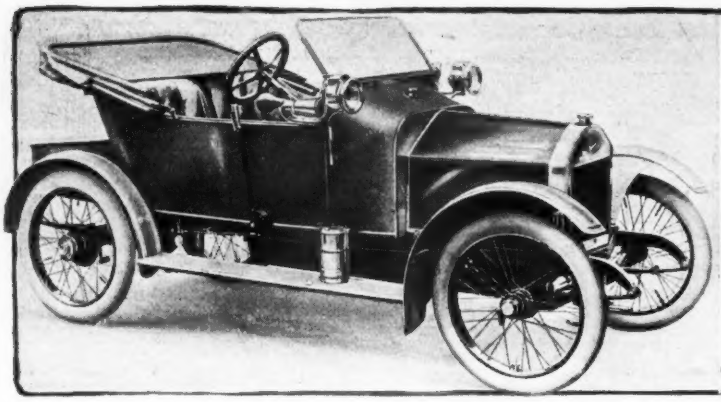
From the term cyclecar one would of course infer that this type of car would be the specialty of the builders of cycles and motor cycles. This, however, does not appear to be the case as the leading cars of the class are not being produced to any major degree by the cycle firms.

Many Light Cars Shown

There are of course a large number of small cars which are slightly over the weight specified, which are therefore not designated as cyclecars, being termed light cars, and it therefore is evident that sooner or later some distinction other than weight may be called for. However, the aim of all the builders of light cars and cyclecars is to produce reliable carriages to carry two passengers which shall be light on the pocket, light in weight, light on tires and light in gasoline consumption.

In a new development one is sure to find a number of freak cars, and there are many designs which are clearly the outcome of inexperience, and bear the mark of the ingenious but misguided enthusiast.

There are a good many novel features among transmission systems, and in some of the cyclecars that are belt-driven variable-diameter pulleys are fitted in several cases and when solid or fixed pulleys are fitted there is an undoubted tendency



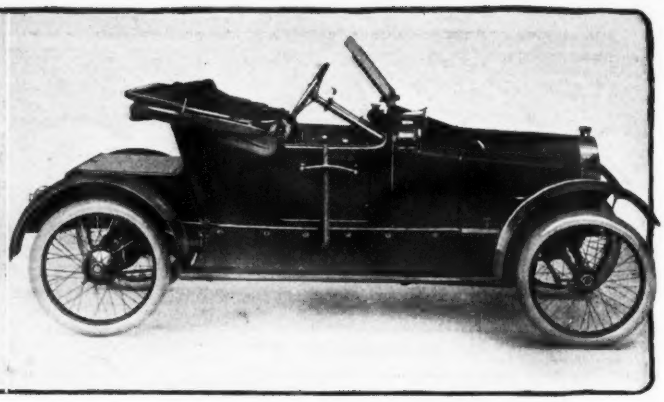


Fig. 13—At left—Swift light car with gasoline tank in scuttle dash. At right—Humberette water-cooled light car

to increase their diameter, doubtless for the purpose of getting a better grip upon the pulley and of diminishing the pull upon the belt.

There are some ingenious methods shown for adjusting chains and on the shaft-driven models a spring drive has been adopted by one manufacturer.

It has been a noticeable feature of the show that a large number of women have been present, and many of them displayed considerable knowledge of the technicalities and were evidently *bona fide* purchasers. Motoring is gaining many adherents among women, and their numbers will increase with greater rapidity with the introduction of a wide choice in easily handled small cars such as the motorcycle exhibition provides. Their small size and low weight enable them to be very easily driven by a woman.

Pedal Self-Starters

Excellent protection from the weather, clean and enclosed transmission, render driving a not uncleanly matter. Interchangeable wheels, which are now common to most makers, very much reduce tire trouble, while easy starting devices are coming into prominence. A pedal-starting apparatus is a common feature of the sidecar combination, and except that most of these small engines are very easily started there is no reason why some similar device should not be found on every cyclecar of the future.

Four-Cylinder Motor Gains

Considering the more important features in detail and referring in the first case to engines, there is a marked tendency to employ the four-cylinder engine and a number of makers, who, during the 1913 season, fitted twin-cylinder, vertical, water-cooled engines, now show four-cylinder models.

In a four-cylinder engine, owing to the increased number of parts, there are more possibilities of trouble, though, admittedly, they are remote, and thus the present tendency is not towards the simplification of the power plant, but as the public is apparently asking for the four-cylinder, the manufacturers are justified in meeting that demand. It has been proven that the four-cylinder engine can be run quite as cheaply as the two, and it is admittedly a much pleasanter engine to control, especially with the popular automatic foot-controlled carbureter fitted to a large number of engines on show.

A popular engine is the Blumfield; and these engines are made in single-cylinder form, as V-type engines and a very well designed 10-horsepower four-cylinder water-cooled one is also to be seen. The V-type engines are made both air-cooled and water-cooled and the same remark applies to the single-cylinder ones.

The Singer four-cylinder engine exhibits some excellent designs and constitutes one of the most compact power plants to be seen throughout the show.

In discussing compact design mention should be made of the Day-Leeds 10-horsepower four-cylinder engine with two-bearing crankshaft and roller-chain driven camshafts and magneto. The cylinder and top half of the crankcase are cast in block and no doubt this feature gives considerable rigidity to the whole design, and at the same time reduces the amount of machining necessary.

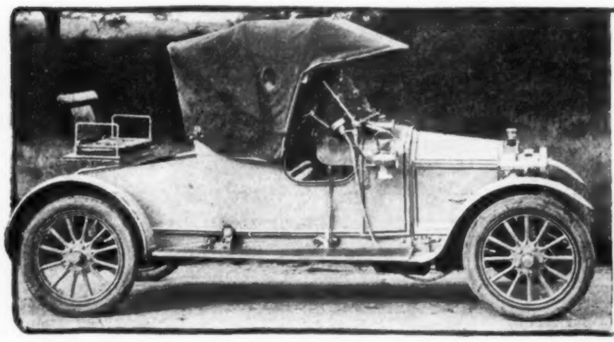
Another excellent little engine—but having two cylinders only—is the Coventry-Simplex. Here again the cylinders are block, and the crankshaft has ball bearings and among other up-to-date features is the silent-chain drive of the camshaft.

Again the T. A. B. engine on the score of compact and clean design leaves nothing to be desired; this little engine has a built-up crankshaft and mechanical lubrication.

The Premier company, Coventry, showed a nice four-cylinder block engine with a bore and stroke of 60 by 92, having thermo-syphon cooling.

Thermo-Syphon Cooling Is King

Water-cooled engines have their jacket arrangements suited for thermo-syphon cooling, and there is little doubt that the pump is *de trop* in the case of engines of such small cylinder capacity as most of those exhibited. The most important item of the thermo-syphon system, the radiator is generally of the tubular type; doubtless the honeycomb type is more expensive and is as well more likely to start a leak on the road due to some undue strain being put upon it.



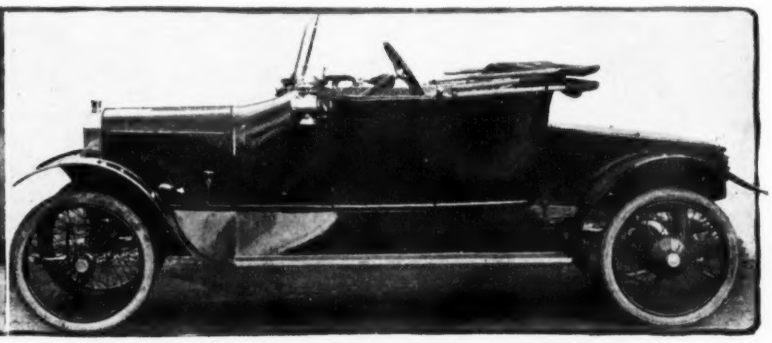


Fig. 16—At left—Wolseley Stellite car completely equipped. At right—Marshall Arter light car with full equipment

Automatic carbureters are generally fitted and the design is in most cases such that the throttle is controlled by a pedal; some makers, however, have provided a hand control as well, and though this leads to some slight complication yet in the opinion of many drivers the advantage of combined control are worth the additional parts.

Cone Clutches in Demand

As regards clutches, the most popular form is still the leather cone type, but the tendency is to increase the width of the face and to lessen the spring pressure. Clutches were probably the most unsatisfactory part of some of the earlier models owing to the fact that sufficient diameter and width of face were not allowed, the makers relying on great spring pressure to prevent slip. The resulting clutches were harsh in action, which, in turn, resulted in damage to the transmission. As an example of the excellence with which a leather cone clutch may be made to operate, those fitted by the Swift and Singer companies may be mentioned.

Manufacturers are beginning to realize that a certain amount of frame whip must take place, and are, therefore, fitting flexible joints to the connecting shaft between the clutch and the gearbox. If the shaft is made rigid, the clutch is thrown out of alignment over bad roads, resulting in harsh engagement, excessive wear, noise, and sometimes breakage.

Making Stronger Gear Boxes

With regard to the gearbox, it is noticeable that larger bearings are being provided and that tooth width has been increased. The fact was overlooked in the past that the speed-change mechanism of the light car or cyclecar has to endure very much

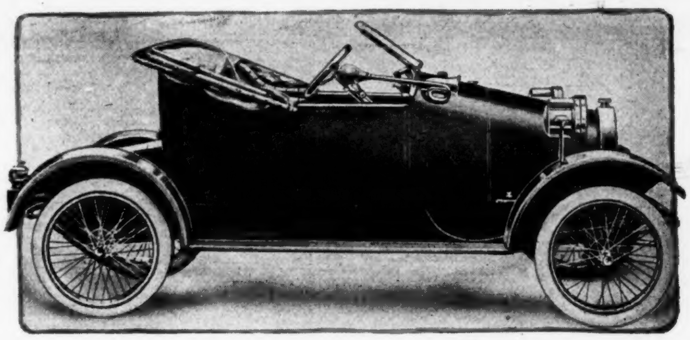


Fig. 14—Crescent light car equipped with headlights, horn and top. Note mounting of headlights on fenders

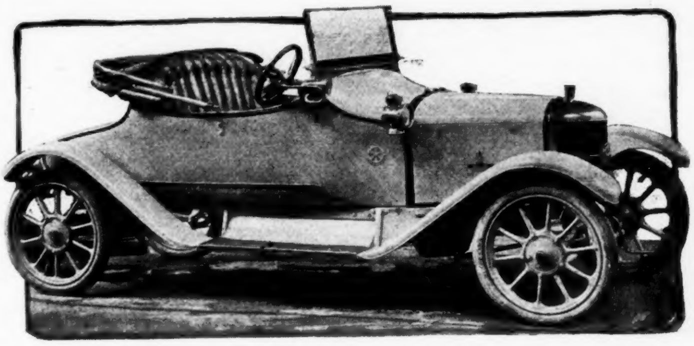


Fig. 15—Auto-Carrier light car with streamline body and V radiator

Analysis of British Light and Cyclecars

General Cyclecar Design

Shaft-driven.........four-wheelers	62
Monocars	5
Belt-driven..........four-wheelers.	21
Friction-driven.......four-wheelers.	9
Three wheelers	13
Chain-driven.........four-wheelers	34

Engine and Number of Each

J. A. P.	19
Precision	19
Chapuis Dornier	3
White & Poppe	1
Fafnir	2
Salmon	1
Anzani	1
Blumfield	2
Alpha	1
Buchet	1
Dorman	2

Cooling System Used

Three-wheelers—	
Air-cooled	7
Water-cooled	6
Chain-driven four-wheelers—	
Air-cooled	6
Water-cooled	7
Belt-driven four-wheelers—	
Air-cooled	12
Water-cooled	10
Friction-driven four-wheelers—	
Air-cooled	1
Water-cooled	8
Shaft-driven four-wheelers—	
Air-cooled	7
Water-cooled	55
Monocars—	
Air-cooled	5
Water-cooled	0

Transmission Systems in Vogue

Three-wheelers—	
Chain	3
Shaft and chain	5
Shaft and bevel	4
Double chain	1
Chain-driven four-wheelers—	
Single chain	1
Chain	11
Shaft and chain	1
Belt-driven four-wheelers—	
Shaft and belts	6
Chains and belts	10
Shaft friction gear and belts	[illegible]
Friction gear and belts	1
Friction-driven four-wheelers—	
Friction and chain	8
Friction and shaft	1
Shaft-driven four-wheelers—	
Shaft and bevel	35
Shaft and worm	19
Monocars at the show—	
Single chain	3
Chain	1
Chain and belts	1

Steering Systems Utilized

Three-wheelers—	
Pillar	3
Direct	5
Wheel	2
Wheel and chain	2
Chain-driven four-wheelers—	
Wire and bobbin	1
Direct	5
Rack and pinion	4
Worm and sector	1
Belt-driven four-wheelers—	
Wire cables	8
Direct	4
Worm and nut	3
Rack and pinion	2
Center pivot	2
Friction-driven four-wheelers—	
Rack and pinion	5
Direct	1
Wheel and sector	2
Worm and nut	1
Worm and sector	1
Shaft-driven four-wheelers—	
Direct	3
Rack and pinion	13
Worm and pinion	3
Pillar	1
Worm and sector	16
Steel cables	3
Bevel and sector	3
Worm and nut	2
Worm and segment	6
Worm and wheel	6
Eccentric	1
Monocars and how driven—	
Wire and bobbin	4
Direct	1

Types of Clutches Used

Three-wheelers—	
Plate	1
Multiple-disk	1
Leather cone	5
Expanding	2
Disk	2
Metal	1
Chain-driven four-wheelers—	
Multiple-disk	3
Plate	5
Disk	1
Leather cone	1
Ferrodo cone	1
Belt-driven four-wheelers—	
Metal cone	2
Leather to metal	4
Cone	1
Plate	1
Multiple-disk	1
Leather cone	1
Shaft-driven four-wheelers—	
Leather cone	37
Cone	17
Multiple disk	8
Multi-plate	3
Single-plate	1
Metal disk	1
Monocars—	
Multi-disk	4
Metal cone	1

Number of Speeds in Cyclecars

Three-wheelers—	
Two speeds	8
Three speeds	1
Three speeds and reverse	2
Two speeds and reverse	1
Chain-driven four-wheelers—	
One speed	1
Two speeds	1
Three speeds	1
Two speeds and reverse	5
Three speeds and reverse	5
Belt-driven four-wheeler—	
Two speeds	7
Three speeds and reverse	4
Four speeds and reverse	2
Seven speeds and reverse	1
Variable	7
Friction-driven four-wheelers—	
Four speeds and reverse	2
Five speeds and reverse	2
Six speeds and reverse	2
Seven speeds and reverse	3
Shaft-driven four-wheelers—	
Two speeds and reverse	10
Three speeds and reverse	51
Four speeds and reverse	1
Monocars—	
One speed	3
Two speeds	2

NOTE:—When more than one type or power of car is made the figures include each type.

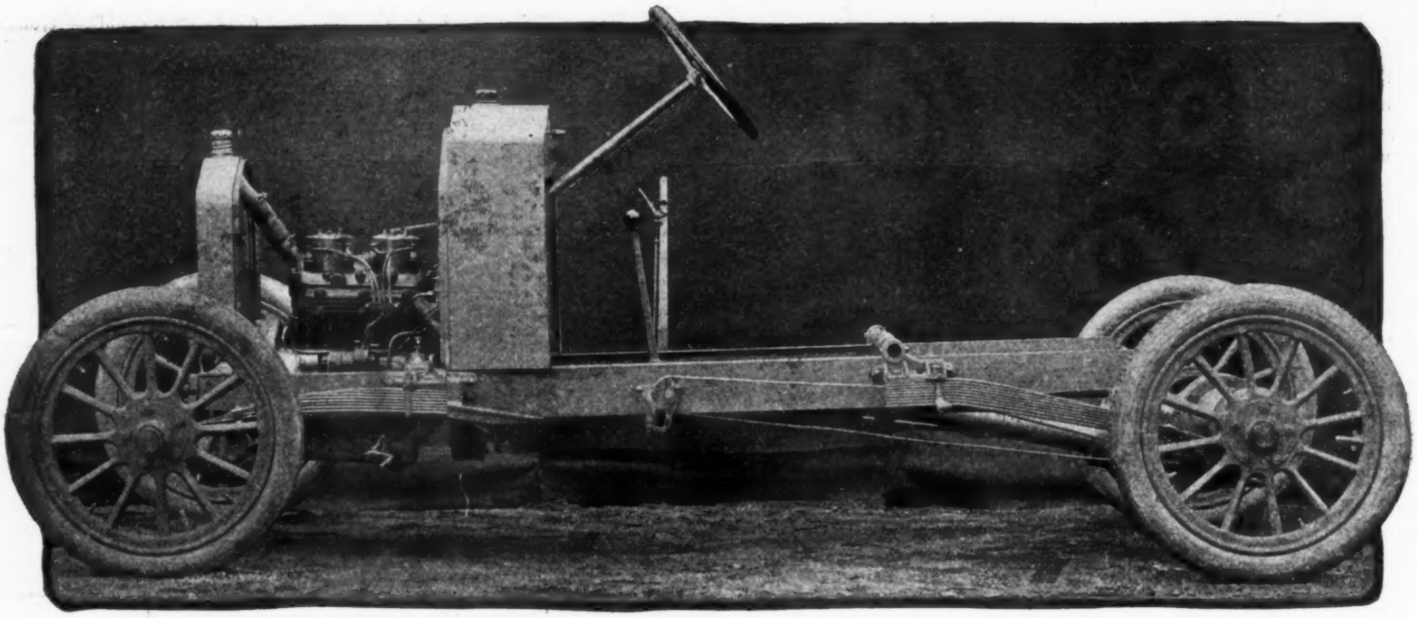


Fig. 1—Chassis of Wolseley Stellite car with cylinders 2 7-16 x 3 1-2 inches. Wheelbase 96 inches, tread 46 inches. Frame wood sill with steel flitch plates

more frequent use than is the case with the change-speed gear of large and heavily powered cars. Many a powerful car can run all day without the use of half the gears contained in the gearbox—the drive being almost continuously direct. This is far from the case with the cyclecar when in bad weather and over heavy roads the speed lever has constantly to be handled. It is noticeable at Olympia that manufacturers now thoroughly realize this fact.

Presumably on the score of expense the four-speed gearbox is not much used, though clearly the less powerful the engine the more does it become necessary to increase the choice of gear ratios. It is not at all unlikely that during the coming season or perhaps at next year's exhibition, the four-speed gearbox will appear as a necessary part of the light car, if not of the cyclecar.

Putting Gearbox on Rear Axle

There is undoubtedly a tendency to transpose the gearbox from the center of the frame to the back axle. The Singer light car has always had this feature, but the new 10-horsepower A. C. shows that other makers are devoting their attention to combining the gearbox with the axle casing. There are a number of points in favor of this system, the chief of which is that the entire transmission unit consists of propeller shaft, gearbox, and back axle, all being assembled separately and then mounted on the frame. The unsprung weight is increased, but it is not apparently found that this, in turn, increases the tire wear.

Direct drive on top gear is standard with all cars except the Singer, and on this car all three speeds are indirect. The rather peculiar design of the gearbox is accountable for this.

Lower Gear Ratios

Makers have found it desirable to reduce low-speed gears somewhat, the low gear being considered, apparently, as it should be—an emergency gear. As an example of this tendency, the 1913 Swift had a ratio of 12.6 to 1, whereas in the 1914 model this ratio has been dropped to 16.8 to 1. And, again, in the case of the Singer the low-gear ratio of which was formerly 11.5 to 1, the 1914 model has a ratio of 15 to 1. There is no doubt that there is wisdom in providing a very low gear for emergencies, such as very steep hills of 1 in 5 or thereabouts, and for travelling over very heavy inclined roads against strong head winds: such an emergency gear also proves its usefulness when starting under severe conditions.

Occasionally light cars are met with having only two speeds, and it is considered likely that this is a practice that will not last long. The Stellite and Warren-Lambert are examples of this type, and the makers state that practically all running can be done on the top gear and that the low gear is an emergency one only.

The friction type of change-speed gear does not appear to be receiving the same amount of attention at the hands of English manufacturers as it does from the Continental makers. Curiously enough, it has remained for a British-made light car to demonstrate that a properly designed friction gear can be made to operate with extraordinary efficiency and reliability. The G. W. K., which is referred to, is practically the only friction-driven light car of note constructed in the British Isles.

Bevel Drive Proves Popular

As regards the important consideration of the final drive, there appears to be about equal numbers of bevel and worm. Perhaps the reason why more makers are not fitting a worm drive is on account of the fact that it is undoubtedly more difficult to manufacture a really efficient worm and worm wheel than a bevel and crown wheel. Perhaps, too, the question of silent running is not of so great an importance in the case of a cyclecar as in the case of the larger type of car when a high price is being paid.

Eliminating the Differential

Quite a number of the vehicles on show were entirely without a differential gear, and on the score of simplification this is a step in advance, though perhaps it may be found that the extra wear upon the tires that is sure to take place will more than counter-balance the admitted advantage of omitting the differential wheels.

Tubular frames have in a few cases been replaced by pressed steel frames, and there is little doubt that if the output justifies such a course the adoption of the pressed steel frame is a step in advance. The Swift is an example of the abandonment of the tubular frame for one of pressed steel.

Pressed Steel Detachable Wheels in Vogue

Detachable wheels as a standard are seen in numbers, and some of them are of the wire variety, whereas the majority are of pressed steel, which latter are apparently found to give extremely satisfactory results on light cars, and an added advantage is that the spare wheel does not take up much room, which is an important point on a small car on which there is not too much spare space. When detachable wheels form part of the standard equipment, a spare wheel is always included in the selling price. There are a certain number of cases in which

this wheel is not supplied without a tire, which appears to be a rather short-sighted policy. Of course it is a question of reducing the cost to the maker as much as possible, but a spare wheel is of no use to the purchaser unless provided with a spare tire.

Better Bodies Are Fitted

The bodywork has been considerably improved in practically every machine. It was found that, in a number of cases, the body developed rattle after a time owing to the light weight of the vehicle and the vibration engendered by driving at high speeds over rough roads. More solid bodies are now fitted, providing greater comfort to the occupants.

Extra Equipment Furnished

Consideration of a number of makers' prices shows that there is a tendency to increase these somewhat, but an examination of the machines points strongly to the fact that this increase of price is justified by the extra value given in the shape of more comforts and more conveniences generally, and sometimes the addition of a spare wheel.

It is noticeable that a few makers include complete dynamo lighting sets in the price of a light car, and there is a demand for small sets of moderate cost in place of an equipment of the usual oil and acetylene lamps. A special model 10-horsepower Singer is listed for next year complete with lighting set.

Some of the small cars, such as the Swift, have a very neat appearance enhanced by a tapered bonnet and radiator with rounded edges; while running boards on either side give to the machine a very finished appearance. Even the neat superficial examination of the exhibits shows that a great deal of time has been spent by manufacturers and their designing staffs during the past year in an attempt to improve the machines for which they are responsible; perhaps it was to be expected, however, that a greater number of manufacturers would have entered the cyclecar field by the present date—the demand for such vehicles having recently shown itself to be a very large and increasing one.

British Cyclecars and Light Cars

Wolseley's Engineering Work

The Wolseley stellite car, rated at 9.506 horsepower, has four cylinders, 2 7/16 by 3 1-2 inches, with a normal crankshaft speed of 1600 revolutions per minute. The cylinders are cast in block, but with separate heads in one casting, and this latter attached to the cylinder by eight studs. This arrangement, although it introduces two additional surfaces that have to be milled, yet brings about a cheaper construction generally.

The boring and grinding of the cylinder barrels is also much facilitated. The exhaust valves are in pockets whereas the inlet valves are over the pistons; these latter valves are in cages and are operated by rocking levers, and vertical push rods—all the valves being worked from a single camshaft. The inlet valve cages are screwed into place and to remove them for grinding in or examination it is necessary to remove the short rocking arms operating the valves.

The exhaust manifold is ribbed and is held against the cylinder casting by six studs. A Bosch high-tension magneto with fixed timing is fitted. The ignition plugs are set at an angle immediately over the exhaust valves. The water outlet for the thermo-syphon system is cast with the cylinder head casting, but the intake is a separate casting and serves to cover a large square opening in the waterjacket, the opening being necessary for the removal of the core.

The crankcase has no horizontal division, the crankshaft being inserted from one end of the casing. On the flywheel end of the base chamber is an oil pump, and this draws oil from a large rectangular sump and delivers it to the crankshaft bearings.

The clutch is a leather cone and the clutch shaft rests in bearings that are fixed to the crankcase. In this way the engine and the clutch together with its operating gear form a unit. Behind the clutch is a universal coupling. The brake pedal is mounted upon the clutch shaft and this brake has a compensating device on the wire rope system, the rope passing over guide slots in the brake arms.

The worm-and-wheel ratio is 7 to 38 and at normal engine speed the first speed gives 9 1-2 miles per hour, and the second 24 miles per hour. The reverse gives 8 1-2 miles per hour. The range of speed on the top gear is pretty considerable, being from 8 to 35 miles per hour. There is an inspection door at the back end of the axle casing. The design of the axle casing and that of the gearbox is very neat and there is an absence of webs and projections. The back axle, gearbox, torque tube,

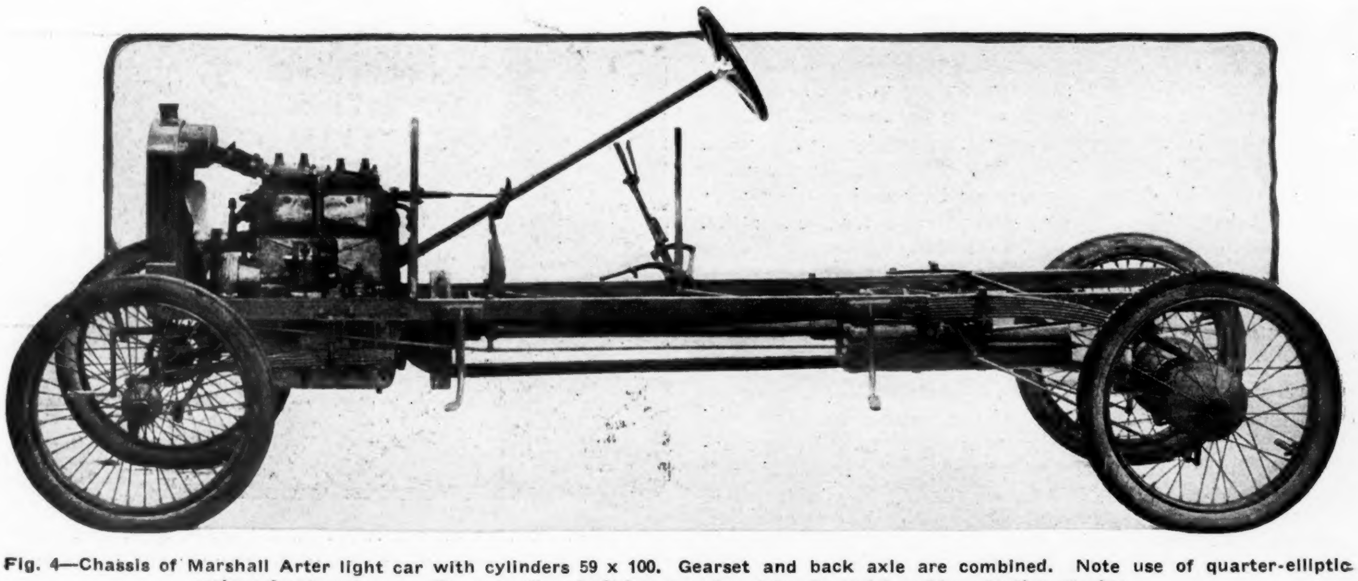


Fig. 4—Chassis of Marshall Arter light car with cylinders 59 x 100. Gearset and back axle are combined. Note use of quarter-elliptic springs front and rear. The propeller shaft has a spring drive to resist sudden starting strains

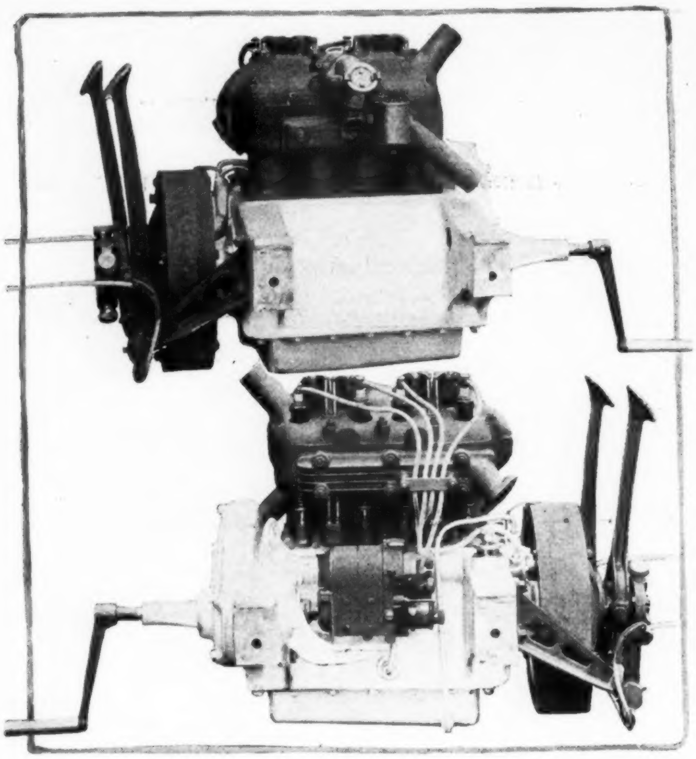


Fig. 12—Two views of motor on Wolseley Stellite car cylinders 2 7-16 x 3 1-2. Note detachable cylinder heads with one set of valves in same. Further note bracket for supporting control pedals

quarter-elliptic springs, brakes and spring brackets form a complete and easily detachable unit.

Two independent internal enclosed brakes are fitted and both are arranged in drums upon the back wheels. The front axle is on the same unit system as the back axle, the whole axle with its coupling rod, quarter-elliptic springs and spring brackets being readily detached. Both brakes are actuated by steel wires. The frame is composed of wood with steel flitch-plates, there being a tubular cross member at the rear end while at the front end the engine bearers are chiefly relied upon for stiffening the frame. The wheelbase measures 96 inches and the tread 46.

Duo Uses Belt Drive

The Duo light car has a silent-chain drive from the engine to the countershaft, and the countershaft has at each end a variable-diameter pulley and these pulleys take belts which drive large pulleys upon the rear axle. In order to adjust the tension of the belts to suit the pulley diameter, a very ingenious arrangement is provided. The rear springs, inverted semi-elliptics, are mounted upon rocking arms: the forward ends of the springs are also attached to rocking arms pivoted to the frame. The right-hand side arm is extended to form a lever and by the movement of this lever, and through the medium of the springs, the whole back axle can be shifted forward or backward to tighten or slacken the belt. The expanding pulleys are automatic in action and answer to the requirements of the belts.

G. N. Has Quarter-Elliptic Spring

Little alteration is to be found in the design of the G. N. cyclecar for 1914, all its interesting features being retained. The front springing has been modified. Instead of the double quarter-elliptic springs formerly used, single quarter-elliptics are fitted, these being placed on top of the frame while substantial radius rods take the place of the lower ones. In order to counteract the torque from the bevels bending the frame, tie-rods have been added. All the well-known features remain, including the air-cooled 90-degrees, twin engine, the shaft and bevel-driven countershaft and the simple two-speed gearset, operated by dog clutches.

The well-known Auto-Carrier's sociable, a reliable three-wheeler, has a slow-moving, single-cylinder engine; the engine is air cooled but the draught is assisted by two fans driven by friction off the external flywheels. A roller chain transmits from the engine to a two-speed planetary gearset mounted in the rear wheel. A plate-clutch is used.

Auto-Carrier's Complete Rear Unit

The 10-horsepower, four-cylinder, water-cooled engine, 59.1 by 100, has vanes on the flywheel periphery for drawing air through the radiator. The oil pump is at the back end of the crankcase and is driven off the camshaft. The crankcase is built on the one-piece system and has a large door at the back for inserting the crankshaft. There is a large detachable sump and oil reservoir beneath the crankcase proper.

The chief chassis novelty is the rear transmission unit, which includes the propeller shaft casing, the three-speed and reverse gearbox, the live axle and the differential casing as well as the foot and hand brakes. This latter brake consists of a fabric-faced annular disk which is pressed into contact with a revolving disk on a continuation of the propeller shaft. At the end of the propeller shaft casing a chamber is cast to receive the gears and worm and worm-wheel, brackets being provided for housing the bearings where necessary. Two brackets serve to hold in a position the layshaft, which runs on ball bearings, the direct or worm shaft having a spigot roller bearing at its forward end, while the rear end has a ball journal for its support combined with double-thrust bearings. The constant-mesh pinion of the propeller shaft is mounted on a Skefko bearing, held in position by a steel casing.

Three forward speeds are provided, giving ratios respectively of 3 7-8 to 1 on top, which is a direct drive, 7 to 1 on second, and 12 1-4 to 1 on third. There is also a reverse.

The differential cage which carries the worm-wheel runs on large ball races fitted into substantial pressed-steel faces. An oil sump, divided into compartments and cast on one with the axle casings, incloses a layshaft and worm gear. Each compartment is fitted with an oil filler placed in an accessible position. The axle shafts are splined and not square. The rear-

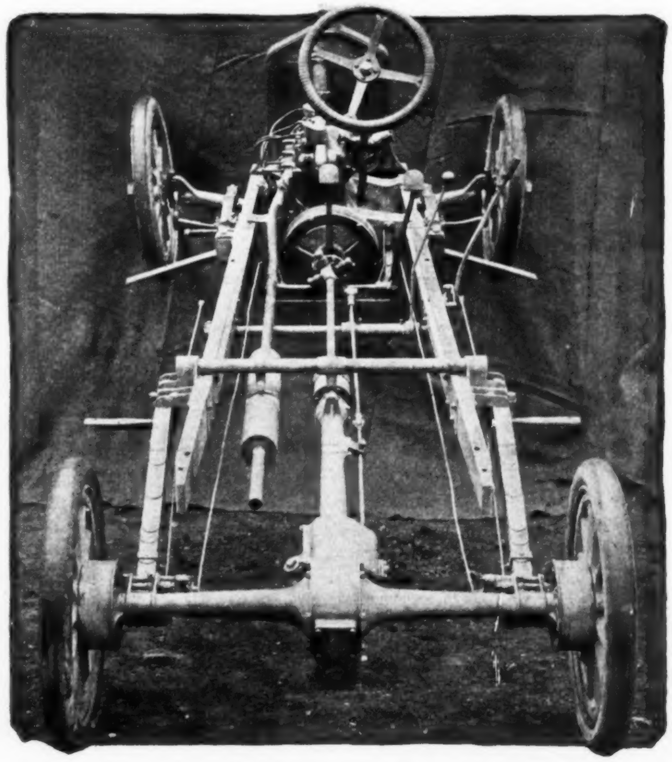


Fig. 7—Rear view of Wolseley Stellite chassis, showing tubular frame cross members, cables for brake operation and rear spring mounting

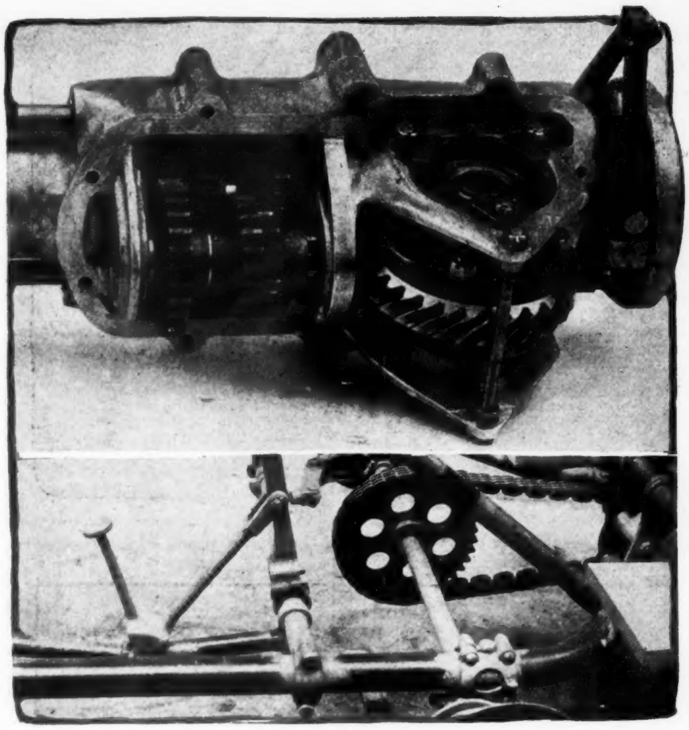


Fig. 6—On top—Unit gearbox with worm reduction to rear axle and disk brake in rear of axle on 10-horsepower Auto-Carrier light car
On bottom—Duo light car silent chain drive between engine and countershaft from which there is belt drive to the rear wheels

wheel brakes, fitted into the hubs, work on the expanding-shoe principle and are well protected from road grit.

Carden Engine in Rear

The Carden monocar is a single-seater. The transmission system is exceedingly simple, the engine being placed behind the rear axle, but although it is placed in this position, it is exposed to a good draught of air for cooling. The steering design resembles that adopted for steering air craft, in that a single cable, carefully guided in tubes, is connected up to the front axle, which pivots as a whole on the center.

Morgan Frame is Muffler Pipe

There is nothing very new to be noted in regard to the 1914 Morgans. One of the most interesting features of this three-wheeler is, of course, the tubular frame. The exhaust pipes are actually two of the frame members. The independent springing of each wheel is a novel point.

Uses Clutch with Friction Drive

One of the most interesting features of the V. A. I. cyclecar is the provision of a separate clutch, although friction disks are employed in the transmission system. The clutch is neatly placed close to the engine, and is operated by the same pedal as the friction disks. The cross-shaft, which carries a differential, is fitted with two sprockets, one at either end, the final drive being by two chains to the back wheels. The steering is by an internally toothed sector working in conjunction with a pinion.

Roc Tricar Gives Steering Option

The machine is a three-wheeler, the steering wheel being in front, operated either by wheel or by tiller. The frame is composed of heavy steel tubes, and is unsprung except for spring forks of the motorcycle type in front. Customers are given the choice of two engines, either a single of 89 by 96 millimeters bore and stroke or a twin of 85 by 85 millimeters bore and stroke, each of which is air cooled. An aluminum case bolted to the crankcase contains a reduction gear from the engine, the bevel gears to drive the magneto, and a gear for starting the engine, one turn of the starting handle rotating the engine through 4 1-2 revolutions. The planetary gearset is also placed here, they give ratios of 6 1-4 to 1 and 11 to 1, no reverse being fitted. From the planetary gearset transmission is by an enclosed shaft to bevel gears in the axle. A spur differential is fitted.

The body is suspended on long springs, which are hinged at the back and allow the whole body to be tipped.

Humberette with Cross Springs

The new water-cooled Humberette model is particularly interesting, as it is practically identical with the air cooled, except as regards the engine. The engine is 84 millimeters by 90 millimeters on both models, giving a capacity of 998 cubic centimeters. In the air-cooled model a large number of thin deep fins are provided to assist in the cooling, air scoops formed in the bonnet assist.

In the other model thermo-syphon circulation through a cellular radiator is used, the cylinders having separate inlets but a common outlet for the water. With these exceptions the mechanical features are identical. A three-speed-reverse gearbox is bolted up to the crankcase, the flywheel and leather cone clutch being thus partially inclosed. Behind the gearbox is a single joint, coupling through an enclosed propeller shaft to the bevel-driven axle, which incorporates a differential.

The suspension is of interest, as a single transverse half-elliptic is employed in front, and quarter-elliptics in rear.

Ranger Gives Choice of Motor

There are two models of the Ranger cyclecar in which the chassis are nearly identical, the power unit being the only difference. There is a choice of either a water-cooled or air-cooled engine. In each case a twin precision 85 millimeters by 85 millimeters is fitted. The lubrication is by drip feed from a tank on the dash, wth an emergency hand pump. A special multi-jet Polyrhoe carbureter supplies the mixture. A Bosch magneto is employed. A leather-faced cone clutch of generous dimensions transmits the power to a short universally joined shaft. The universal joints are made from four strips of steel, bolted together at their extremities. The effect is the same as the spring-ring joints in use on many light cars.

Two speeds and a reverse are provided by the gearbox, the

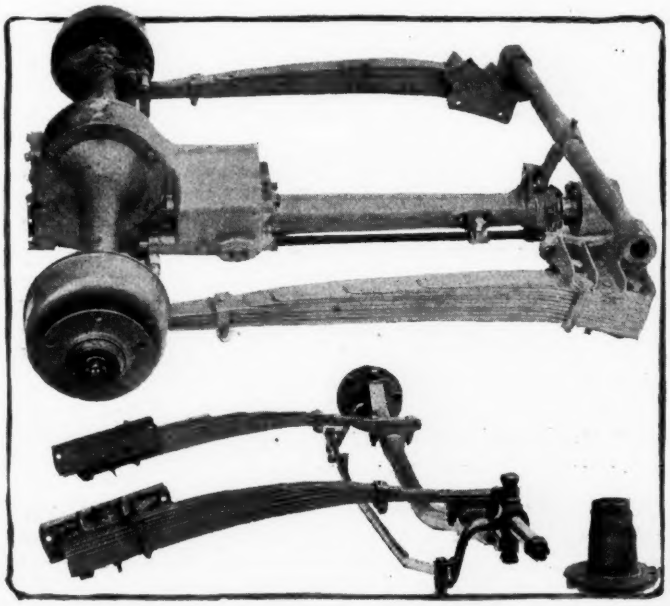


Fig. 2—On top—Rear axle of Wolseley Stellite car with worm gear reduction of 38 to 7. This complete rear axle unit is very easily detachable
At bottom—Front axle unit of the Wolseley Stellite car, showing mounting of quarter-elliptic springs

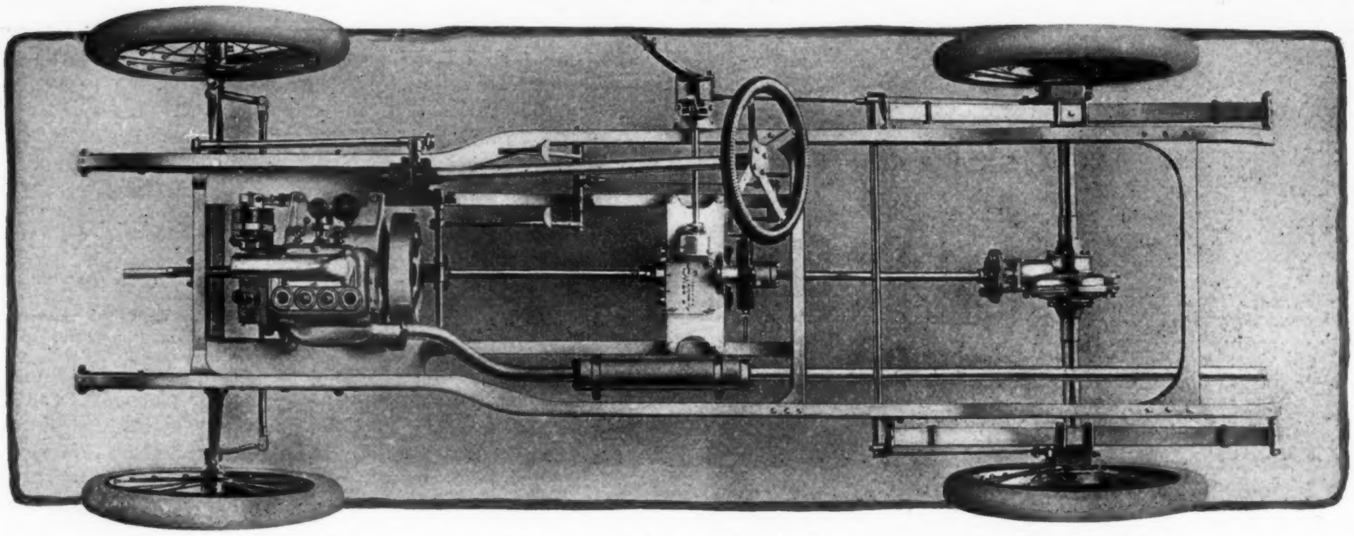


Fig. 8—Chassis of Swift light car with four-cylinder engine and miniature car construction throughout

gears themselves being of the usual sliding spur type. A countershaft, set transversely at the rear end of the gearbox, is driven by bevels contained in the gearbox. On one end of the countershaft is situated the brake drum; at the other the chain sprocket. From this sprocket an ordinary roller chain drives the back axle.

Swift Becomes Real Car

The Swift company has adopted a pressed steel frame in place of the tubular one, and the front axle is of H-section instead of the original tubular one. The steering has been entirely altered, a worm-and-segment replacing the old rack-and-pinion. The steering spindle, neck and arm, are now all stamped out in one piece while a compensating rod with cushion springs is fitted.

The gearbox has been moved rearwards, so as to bring it into line with the gate. This is a decided improvement, as the operating mechanism is simplified, and no long connecting rods are required.

The propeller shaft has two universal joints, and is not inclosed in a torque tube, the rear springs being depended upon to take the torque from the bevels. The front universal is of the plunger type, and a leather ring joint is fitted at the rear.

The engine is the same as that fitted last season and has twin cylinders 75 by 110. Thermo-syphon cooling is adopted and the magneto is mounted at the front end of the engine and is driven by skew gearing. The gearbox provides three forward speeds and reverse and the gears are actuated by a gate change and are mounted upon a castellated shaft which is not always the case in a low-priced car. The design of the back axle does not differ materially from that employed last year, the sleeves have been strengthened somewhat—1-4 inch having been added to their diameter. All the wheels run on ball bearings.

There is a peculiarity in the design of the body; the seats are staggered, the driver's seat being a few inches in front of that of the other occupants of the car. With this arrangement the driver is able to approach his seat without disturbing the passenger. The wheelbase is 87 inches and the tread 43 inches.

Marshall Arter with Spring Drive

There are two models of Marshall Arter light cars, viz., 10-12 and 12-14 horsepower, and the two are identical with the exception of a slight difference in the engine sizes. The 10-12 dimensions are 59 by 100 and 12-14 dimensions are 60 by 110. The cylinder castings are identical, the larger bore being obtained by boring out the castings a trifle more. The first mentioned is within the limits of the cyclecar definition. Both are the very latest type, with forced lubrication. The crankshaft is drilled so that the bottom ends are lubricated in this manner and not on the splash system. A horizontal Zenith carbureter and Bosch magneto, capable of being advanced or retarded by swinging about its axis, are fitted.

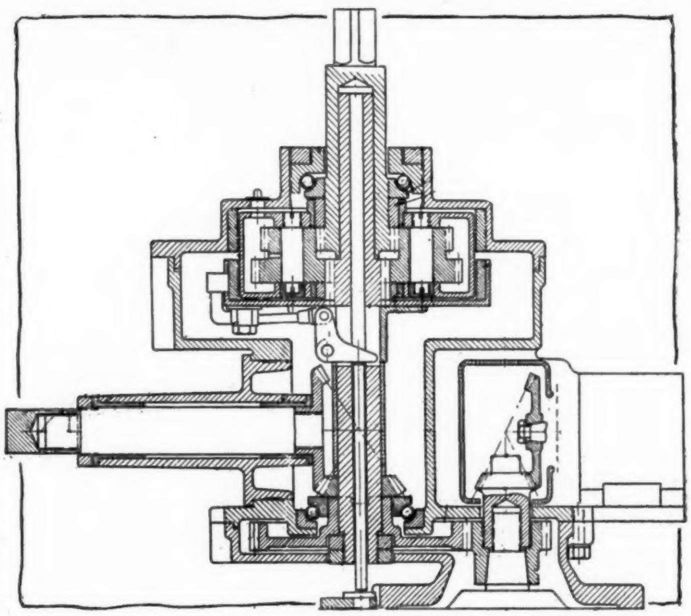


Fig. 10—Complete transmission system giving two speeds on Wall car, this gearset, with operating pedals, weighing 37 pounds

The engines are of the Chapnis-Dornier make and have inclosed valves with adjustable tappets. The clutch is a leather-faced cone.

In the spring drive the ends of a tempered steel bar twist relatively to one another when the power is applied to the driving end, so that this bar absorbs the engine impulses and transmits a more constant torque to the driving mechanism. The steel bar is capable of bending in one direction and swivelling in the other, which allows it to conform to the whip of the chassis. It is incased in a light steel tube and so kept laterally rigid by means of semi-circular wood blocks placed in the middle of the tube.

The gearset and back axle are combined; the arrangement is very compact in design and provides two speeds and a reverse. One of the side plates of the spur differential gear has an extension which passes through the crown wheel that takes the drive from the driving pinion. This extension is square and has mounted upon it a sliding gear and jaw-clutch. This gear has a groove and is slid along the short square shaft in the usual manner. A movement to the left engages the jaw-clutch and gives the desired drive, while a movement to the right throws

the twenty-four-tooth gear into engagement with a twelve-tooth pinion mounted upon a short layshaft. The crown wheel has a twenty-one tooth pinion upon its boss and this pinion is in permanent engagement with a twenty-seven-tooth gear upon the layshaft. In this way the low gear is obtained. The wheels upon the layshaft are always in motion. The gear-changing shaft is a short one and a spring-and-steel-ball device is used for locking either of the gears in position.

Wall Tricar with C-Springs

The Wall cyclecar has three wheels only, the single steering wheel being in front. The frame is unsprung and is made of tubing, the front wheel is however insulated to some extent by means of spring forks. The body is suspended on long C-springs. Either of two engines can be fitted, viz., a single-cylinder engine 89 by 96 or a twin-cylinder engine, 85 by 85. Each of the engines is air cooled. All the gears are contained in an aluminum case bolted to the crankcase. Planetary gears for the main drive, a reduction gear from engine to the planetary gearset, bevel gears to drive the magneto, and a 4 1-2 to 1 gear for starting the engine are all contained in this housing. The planetary gearset mechanism gives ratios of 6 1-3 to 1 and 11 to 1. A reverse can be fitted if required, but is not necessary as the extremely large lock given by the single steering wheel makes turning, in even a fairly narrow road, a matter of great ease.

Transmission to the rear wheels from the gearbox is by an enclosed shaft and bevel gears. A differential is necessary, since the machine is often turned in a very small circle. The steering mechanism is made in two distinct patterns: either direct tiller or nut-and-screw, with a wheel on the steering column.

Warne Has Novel Reverse

There are two models of the Warne, one a belt-driven machine and the other a light car having shaft drive. The former has a very novel type of reverse, consisting of two wheels mounted independently side by side, and one fixed to the sprocket driven by the engine chain and the other attached to the low-gear sprocket. Another wheel, placed in a plane at right angles to the others, can be brought into contact with the latter and so a friction reverse is obtained.

Pyramid Uses New Friction Drive

In the Pyramid light car an 8-horsepower J. A. P. fan-cooled engine is set across a pressed steel frame and the engine has a large external flywheel incorporating a sliding universal joint within a large aluminum oil casing while a short shaft transmits the power to a large friction disk driving another disk sliding on a cross shaft, which is formed of a 2-inch diameter tube carrying adjustable pulleys, whence the final drive is by belts to the rear wheels.

In the shape and application of the friction disks striking originality has been shown. The standard form of friction drive, employing a flat driving disk, suffers from the defect that the spring pressure is constant, thus causing unnecessary wear on the higher gears. In the Pyramid, however, this undesirable feature is avoided, the spring pressure varying proportionally with the gear ratio. The face of the driving disk, instead of being flat, is formed in two steps, Fig. 9. Thus for first and second speed the driven disk rotates on the raised boss, but for the third speed the disk rotates on the lower level, and as the driving disk has moved nearer the countershaft the spring pressure is decreased. For top gear, one side of the friction disk is bevelled, and the driven disk is moved sideways until this chamfered edge engages with a bevel on the driving disk, the spring pressure being again reduced. At the same time, between the two bevels, there is a true rolling contact, and no slipping takes place. A simple-interlocking device, between the clutch pedal and the gear lever, prevents damage to the disk by running on the edge of the boss.

The frame is carried on the straight tubular axles by quarter-elliptic springs, the rear ones serving as radius rods. Steering is by rack and pinion.

On the two following pages, 1144 and 1145, appear tables giving classified lists of light cars and cyclecars on the English market, together with main features.

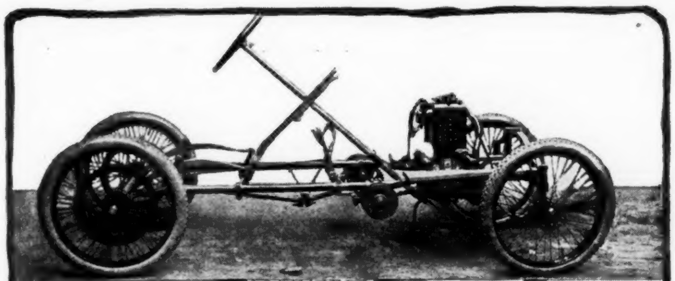


Fig. 3—On top—Chassis of Duo Cyclecar, showing how rear springs are mounted upon rocking arms in order to move the axle forward or back to change the belt tension

On bottom—Rear end of Duo chassis, showing details of spring mounting

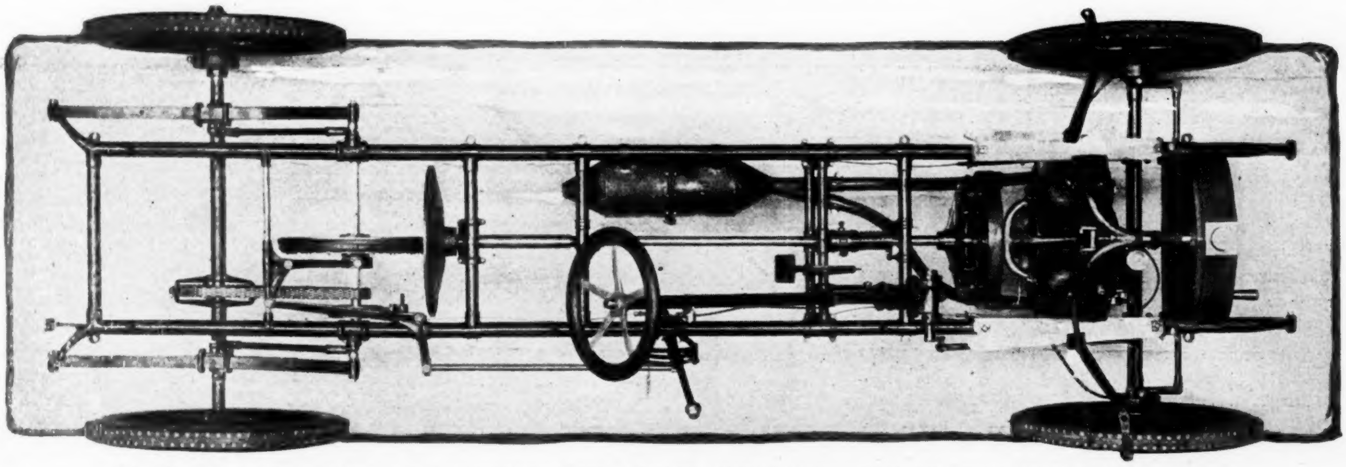


Fig. 5—Plan view of chassis of Crescent cyclecar, showing tubular frame construction and friction transmission

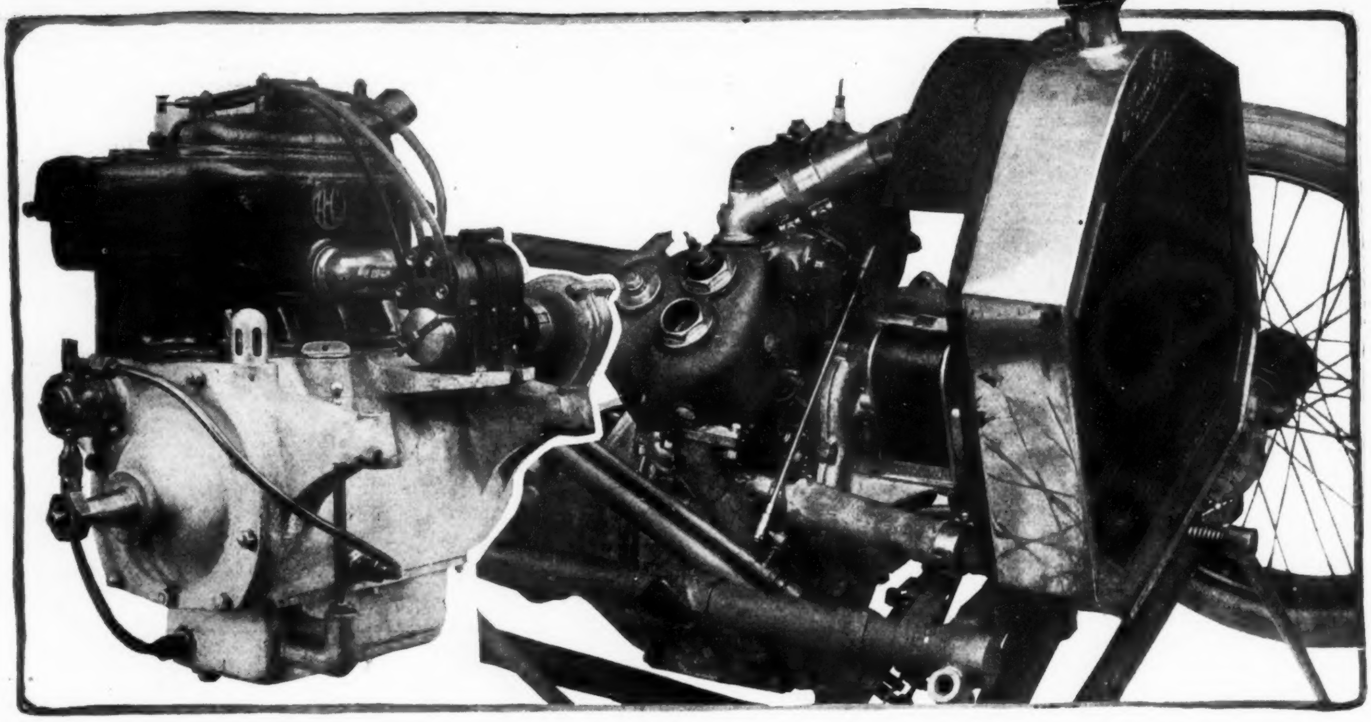


Fig. 11—At left—Four-cylinder motor of Auto-Carrier chassis with cylinders 59x100 mm. At right—Two-cylinder twin motor 84x90 mm. on Humber car. Gearbox is unit with motor, both being carried direct on tubular frame

Analysis of English Light and Cyclecars

Name	Bore and Stroke, mm.	Capacity, c.c.	Cooling	Gear Ratios and Number Speeds	Transmission	Price
Monocars.						
Carden A	85x 85	487	A.	5.5 to 1	Sing.C.	$295.50
L. A. D	90x120	763	A.	5 to 1	Sing.C.	300.00
Carden B	70x 84	647	A.	5 to 1	Sing.C.	335.00
Carden C	70x 64½	496	A.	5 & 10 to 1	C.	360.50
D. E. W	89x 97	604	A.	5 & 8½ to 1	C.&B.	375.00
Three-Wheelers.						
A. C	95x102	723	A.	4½ & 12¾ to 1	C.	$390.75
Motorette	76x 85	386	W.	4½ & 13½ to 1	C.	390.75
Morgan	85x 85	965	A.	4½ & 8 to 1	S.&C.	447.50
Morgan	85x 85	965	A.	4½ & 8 to 1	S.&C.	455.00
Wall Tricarriage	89x 96	597	A.	5¼ & 10 to 1	S.&B.	470.50
C. & H	70x 80	615	W.	4½, 7 & 10 to 1	C.	495.75
Morgan	85x 85	965	A.	4½ & 8 to 1	S.&C.	500.00
Wall Tricarriage	85x 85	965	A.	5¼ & 10 to 1	S.&B.	505.85
Morgan (Grand Prix)	90x 77½	986	W.	4½ & 8 to 1	S.&C.	525.00
Morgan (Grand Prix)	90x 77½	986	W.	4½ & 8 to 1	S.&C.	575.00
Eric	56x 76	747	W.	5, 9 & 17 to 1	S.&B.	705.75
Eric	69x 90	1343	W.	5, 9 & 17 to 1	S.&B.	785.50
Phanomobile	82x110	1160	A.	4 & 11 to 1	D.C.	835.00
Belt-Driven Four-Wheelers.						
Stag	90x120	765	Fan		S.&B.	$447.50
D. E. W	85x 85	965	A.	4.5 & 9.7 to 1	C.&B.	475.00
D. E. W	85x 85	965	W.	4.5 & 9.7 to 1	C.&B.	575.00
Paragon	85x 95	1074	A.	4.7 to 1 to 9.5 to 1	C.&B.	575.00
Buckingham	89x120	746	A.	4 & 8 to 1	C.&B.	575.50
Automobilette A	85x 85	965	W.		S.&B.	600.00
Warne B	85x 85	965	A.	3¾ to 1 to 12 to 1	C.&B.	600.00
D. M. C	89x 89	1106	A.	4 to 1 to 12 to 1	F.G.&B.	600.00
Gibson	65x110	1456	W.	3¾, 5¾ & 9¾ to 1	G.&B.	600.00
Pyramid	85x 85	965	A.	4.5, 6.7, 11 & 21 to 1	F.G.&B.	625.00
Buckingham	89x120	746	W.	4 & 8 to 1	C.&B.	630.00
G. N	84x 98	1086	A.	4 & 8¼ to 1	C.&B.	630.00
de P.Duo	88x 90	1095	A.orW.	4 to 1 to 15 to 1	S.&B.	657.50
Adamson	83x 95	1099	W.	3.3, 6.3 & 11.3 to 1	S.&B.	657.50
Buckingham	89x 88	1095	W.	3½ & 7 to 1	C.&B.	705.75
Automobilette B	72x130	1088	W.		S.&B.	720.00
Automobilette B4	59x100	1093	W.		S.&B.	880.00
Bedelia	80x100	503	A.	5 to 1 to 14 to 1	C.&B.	......
Bedelia	82x100	1056	A.	Top 4 to 1	C.&B.	......
Bedelia	82x100	1056	W.	4, 6 & 9 to 1	B.	......
Buckingham	89x120	1492	A.	3½ & 7 to 1	C. &B.	......
Friction-Driven Four-Wheelers.						
Ajax	57x 95	970	W.	Top 4 to 1	F.&C.	$440.00
Armstrong	85x 85	965	A.	4½ to 1 to 12½ to 1	C.	525.00
Tweenie	72x120	977	W.	4 to 1 to 12 to 1	C.	575.50
V. A. L	85x 85	965	W.	Top 3 1-3 to 1	F.&C.	625.00
Tweenie	90x120	763	W.	4 to 1 to 12 to 1	F.&C.	630.00
Crescent		1095	W.	3¾ to 1 to 12 to 1	F.& Sil.C.	635.00
Violet Bogey	73x130	1088	W.		F.&C.	710.50
G. W .K	85.8x 92	1065	W.	4.3, 5.3, 7 & 11 to 1	F.&S.	750.00
Tweenie	65x110	1460	W.	4 to 1 to 12 to 1	F.&C.	890.50
Shaft-Driven Four-Wheelers						
Zendik	85x 85	965	A.	4¼ & 8¼ to 1	S.&B.	$550.00
Monarch	85x 85	965	A.	5¼ & 9½ to 1	S.&B.	575.00
Humberette	84x 90	998	A.	4.46, 7.8 & 13.5 to 1	S.&B.	600.00
Chater Lea	85x 85	965	A.	4½, 6¾ & 12½ to 1	S.&W.	600.00
J. B. S	85x 85	965	A.	4½, 6½, 9 & 14 to 1	S.&B.	600.00
Warren-Lambert		1096	W.	4½, 7 & 14 to 1	S.&B.	625.00
Jowett	72x101.5	815.8	W.	4.56, 6.615 & 11.926 to 1	S.&B.	625.00
Monarch	85x 85	965	W.	5¼ & 9½ to 1	S.&B.	625.50
Woodrow	85x 96	1086	A.		S.&W.	630.00
Alldays Midget	86x 92	1069	W.	4.5, 7.8 & 11.7 to 1	S.&W.	650.00
Duo	89x120	746	W.	5.6 & 10.6 to 1	S.	650.00
Humberette	84x 90	998	W.	4.46, 7.8 & 13.5 to 1	S.&B.	675.00
Tiny			W.	4½, 7 & 12 to 1	S.&B.	675.00
Beacon	85x 96	1086	A.	4½, 6¾ & 10½ to 1	S.&W.	675.00
Eagle	85x 96	1086	W.		S.&W.	675.00
Warne (C)	85x 85	965	W.	4, 7½ & 14 to 1	S.&W.	675.00
Chater Lea	85x 85	965	W.	4½, 6½ & 12½ to 1	S.&W.	680.50
Enfield-Autolette	86x 92	1068	W.	4.5, 7.8 & 11.7 to 1	S.&W.	690.00
Woodrow	85x 85	965	W.		S.&W.	700.00
Swift	75x110	972	W.	4.2, 7.15 & 16.8 to 1	S.&B.	700.00
Autocrat	86x 95	1104	W.	4½, 7½ & 12 to 1	S.&B.	705.75
Chain-Driven Four-Wheelers						
L. A. D	90x120	763	A.	5 to 1	S.C.	$375.00
L. M	85x 85	965	A.	4¾ & 10½ to 1	C.	495.75
A. C	95x102	723	A.	4½ & 12¾ to 1	C.	500.00
Gilyard	82x120	1267	A.	3¾, 5¾ & 8¾ to 1	C.	525.00
Gordon	85x 95	1074	A.	4½ & 10 to 1	C.	525.00
Gordon	85x 95	1074	W.	4½ & 10 to 1	C.	600.75
A. C. E	56x 76	749	W.		C.	600.00
Ranger	85x 85	965	W.	5.02 & 10.05 to 1	C.	635.00
Cumbria	85x 85	965	A.	4½, 8, & 12½ to 1	C.	641.00
Adams	85x 96	1086	W.	4 & 16 to 1	C.	650.00
Crouch Garette	80x 90	904	W.	4½, 8 & 14 to 1	C.	660.75
Invicta	85 x85	964	W.	4½, 9 & 15 to 1	S.&C.	700.00

Name	Bore and Stroke, mm.	Capacity, c.c.	Cooling	Gear Ratios and Number Speeds	Transmission	Price
L. M	85x 85	965	W.	4¼, 7 7-10 & 11 1-6 to 1	C.	705.75
Marshall-Arter	85x 85	965	W.	4.63 & 11.9 to 1	S.&B.	705.75
Arden	85.8x 95	1099	W.	4, 8½ & 13 to 1	S.	725.00
Perry	72x108	875	W.	4.9, 8.25 & 13.9 to 1	S.&B.	735.00
Day-Leeds	59x100	1093	W.	4.5, 7 & 12.9 to 1	S.&B.	750.00
Zebra	88x106	645	W.		S.&B.	750.00
Jennings	80x108	1098	W.	5, 8.6 & 14.6 to 1	S.&B.	750.00
Medinger (2-stroke)	80x 99	995	W.		S.&B.	750.00
Lagonda	67x 78	1100	W.	3,857, 6.38 & 11.16 to 1	S.&W.	750.00
Duo	78x100	956	W.	5.6, & 10.6 to 1	S.	750.00
New Imperial	64x 85	1093	W.		S.&B.	762.50
Melen	86x 95	1104	W.	4, 8.25 & 13.5 13.5 to 1	S.&B.	779.00
Alldays-Midget	59x100	1093	W.	4.5, 7.8 & 11.7 11.7 to 1	S.&W.	785.50
Averies	59.1x100	1096	W.	4, 7 & 10½ to 1	S.&W.	785.50
Stellite	62x 89	1072	W.		S.&W.	785.50
Marshall-Arter	59x100	1093	W.	4.63 & 11.9 to 1	S.&B.	785.50
Enfield-Autolette	59x100	1093	W.	4.5, 7.8 & 11.7 to 1	S.&W.	790.00
Marshall-Arter	60x110	1244	W.	4.63 & 11.9 to 1	S.&B.	795.60
Aeden	59x100	1093	W.	4, 8½ & 13 to 1	S.	800.00
Douglas	88x 88	1070	W.	4.5, 7 & 12.5 to 1	S.&B.	800.00
Winco	86x 92	1061	W.	4½, 7.6, & 10.6 to 1	S.&B.	825.00
Chater Lea	59x100	1093	W.	4¼, 6¾ & 12½ to 1	S.&W.	825.00
Duo	58x100	1057	W.	5.6 & 10.6 to 1	S.	825.00
Autocrat	59x100	1093	W.	4¼, 7 1-3 & 12 to 1	S.&B.	840.00
Calthorpe-Minor	62x 90	1088	W.	4, 6.78 & 11.75 to 1	S.&B.	840.00
Baby Peugeot	55x 90	855	W.		S.&B.	850.00
Eagle	60x100	1131	W.		S.&W.	875.00
A.-C.	59.1x100	1096	W.	3¾, 7 & 12½ to 1	S.&W.	875.00
Portland	70x 90	1385	W.	4.15, 6.4 & 11.5 to 1	S.&.B.	875.00
Norma	65x110	1460	W.	4½ to 1 top	S.&B.	890.00
Morris-Oxford	60x 90	1018	W.	Top, 412 to 1	S.&W.	900.00
Wilton	59x100	1093	W.	4, 7 & 13½ to 1	S.&B.	925.00
Cummikar	60x100	1131	W.	4.9 & 14 to 1	S.&B.	925.00
Calcott	65x110	1460	W.	4, 7 & 11 to 1	S.&B.	925.00
Perry	60x110	1244	W.		S.&B.	930.00
Wyvern	65x110	1460	W.	4.1, 6.4 & 11.5 to 1	S.&B.	950.00
Standard	62x 90	1087	W.	4.6, 8.4 &-5.5 to 1	S.&B.	975.00
Singer	63x 88	1096	W.	4.2, 7.9 & 15 to 1	S.&B.	975.00
Automobilette	60x100	1131	W.		S.	980.00
Morris-Oxford	60x 90	1018	W	Top, 4.6 to 1	S.&W.	995.50
Hillman	60x120	1357	W.	4.5, 7.63 & 13.12 to 1	S.&W.	1000.00
Coventry-Premier	60x 92	1046	W.		S.	......

ABBREVIATIONS.—Under Cooling, A. is air, and W. water. Under Transmission, C. is chain, D. C. is double chain, S. is shaft, B. is bevel, except on the belt-driven cars where it is belt; F. is friction, G. is gear. Sil. C. is silent chain, Sing. C. is single chain, and W. is worm.

Recent Decisions of the Law Courts

By George F. Kaiser

HOW necessary it is that automobilists pay careful attention to their policies insuring them against loss by collision, etc., is shown in a recent New York case. An automobile was running along a Jersey road, the side of which sloped from the macadam road bed at an angle of 30 to 45 degrees into a deep ditch. The automobilist turned out of the road to avoid a horse and wagon coming from the opposite direction, whereupon the hind wheels skidded on the turn and threw the rear of the machine into the ditch. Upon attempting to regain the road the right hand front wheel collapsed and the automobile turned over. Suit was started by the owner against the insurance company on the portion of the policy which read:

"This policy . . . is extended to indemnify the insured against loss or damage to . . . the automobiles herein described . . . if caused solely by collision with another object either moving or stationary (excluding, however . . . all loss or damage caused by striking any portion of the road bed or striking street or steam railway rails or ties or loss or damage caused by the upset of the insured automobile unless such upset is the direct result of such collision as is covered hereby.")

It was held by the court on appeal by the insurance company that it was necessary for the car owner to prove that the damage sustained was the result of a collision with some moving or stationary object and as, of course, the motorist was unable to prove this his judgment was reversed and his complaint was dismissed. Hardenbergh vs. Employers' Liability Assurance Corporation, Ltd., 141 N. Y. S. 502.

Rights of Unlicensed Driver

In a recent Connecticut case a car owner sued for damages to his car and for injuries to his daughter through another motorist's negligence. At the time of the accident the daughter, who was a minor, was driving. The defendant contended that the daughter was not accompanied by a licensed operator by reason of the fact that the chauffeur sat in the left hand rear seat of the tonneau instead of sitting alongside of the daughter. The father on the other hand, contended that the chauffeur did accompany the girl as he was near enough to give her any advice or assistance which might be necessary. The Court took the father's view of the matter and said that even though the chauffeur was sitting in the tonneau at the time of the accident he was in a position where he might render any necessary aid with reasonable promptness and that he might be better able to give assistance by reaching over from the rear than if he was sitting alongside of the operator.—Hughes vs. New Haven Taxicab Co., 87 Atl. 721 (Supreme Court of Errors, Conn., July 30, 1913).

North and South Have Right of Way

In New York City all vehicles going in a northerly or southerly direction have the right of way over vehicles going in an easterly or westerly direction. This question of right of way is provided for by Section 448 A of the Ordinances of the City of New York. In a recent case where an automobile truck which had been going northerly but turned to the west and crossed the street car tracks to go up a side street was struck by a south bound trolley car, the court held that the truck driver was to blame and he could not recover damages.—Ebling Brewing Co. vs. Linch, 141 N. Y. Supp. 480.

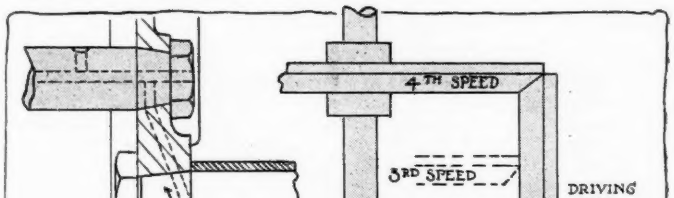


Fig. 9—At left—Oiling system on the J. A. P. At right—Friction drive system on Pyramid car

The Laws of the Motor Windpipe

Inertia of Mixture Causes Many Ills of Carburetion—Valve Action Sets Up Disastrous Wave Action in Manifold—Intake Pipe Pressures Important Facts in Carburetion

By Robert W. A. Brewer

BEFORE considering the question of inlet pipes, it is necessary to have a clear definition of the word inertia, for the carbureter and the carbureting system are, of the details of a motor car engine, the most sensitive to inertia.

Inertia is that property of a body by virtue of which it tends to continue in a state of rest or motion in which it may be placed until acted on by some force.

The masses of air and fuel dealt with by the engine are subject to inertia by reason of the continually changing conditions under which the engine works.

Newton's second law of motion states that "Uniform acceleration is produced by any constant force, the latter being measured by the increase of momentum it produces."

The force producing an acceleration $= \frac{W}{g} \times F$ where

W = the weight of the body,
g is the acceleration of gravity,
And F = the acceleration.

The final velocity of the body is $V = F \times t$, where t is the time during which the acceleration acts.

Every body has an inertia by which it tends to resist a change of velocity, and the kinetic energy of such a body in motion $= \frac{m v^2}{2}$

When we compare first the masses and weights of the two bodies, gasoline and air, we find that a cubic foot of gasoline weighs, say, 45 pounds if its specific gravity is 0.720, and that a cubic foot of air weighs as follows:

THE PROPERTIES OF AIR

Temperature, Fahr.	Volume at Atmospheric Pressure: Cubic Feet. per Pound.	Comparative Volume.	Density in Lbs. per Cu. Ft. at Atmospheric Pressure.
0	11.583	0.881	0.0863
32	12.387	0.943	0.0807
40	12.587	0.958	0.0794
50	12.840	0.977	0.0778
62	13.141	1.000	0.0761
70	13.342	1.015	0.0749
80	13.593	1.034	0.0735
90	13.845	1.054	0.0722
100	14.096	1.073	0.0709
110	13.344	1.092	0.0697
120	14.592	1.111	0.0685
130	14.846	1.130	0.0673
140	15.100	1.149	0.0662
150	15 351	1.168	0.0651
160	15.603	1.187	0.0640

Air expands 1/491 of its volume at 32 degrees Fahrenheit for every increase in temperature of 1 degree Fahrenheit and its volume varies inversely as the pressure.

The volume of 1 pound of air at 32 degrees Fahrenheit = 12.387 cubic feet and at any other temperature and pressure, its weight in pounds per cubic foot is $W = \frac{1.325 \times B}{459.2 \times T}$

Where B = the height of the barometer in inches of mercury.
T = temperature in degrees Fahrenheit.
1.325 = the weight in pounds of 459.2 cubic feet of air at 0° Fah. and 1 inch barometric pressure.

We find therefore that the ratio of the mass of a cubic foot of fuel to that of air is of the order of $\frac{45}{0.0807} = 558$ times as great.

The smaller the quantity of fuel acted upon by a change of engine suction, the smaller will be the inertia, but the velocity of the stream is of great importance as the momentum varies as the square of that velocity.

For these reasons it is advisable to have the orifice in the gasoline jet tube of as little capacity as possible, and to keep the velocity of the fuel through that passage low in cases where inertia effects are likely to be of moment.

In a carbureter system, only small quantities of fuel and air are acted upon and the dimensions of the orifices can be so arranged that inertia factors scarcely come into consideration except at slow engine speeds.

So far as the air is concerned, the effect of lag of flow on account of inertia is to temporarily enrich the mixture, but the lag of fuel flow may be more pronounced than the lag of the air flow, thus giving a weak mixture at first to be followed by a rich mixture when the air flow is retarded. The air enters the mixing chamber more readily than the fuel, but when the throttle is closed there is always the tendency for the fuel to continue flowing unless a suitable damping device is employed.

Valve Action Influences Carburetion

Rapid closing of the inlet valves also sets up a wave motion in the inlet pipe and there are possibly conditions under which wave motion thus set up may synchronize, causing difficult conditions to occur. It is better if such waves of pressure damp each other out before reaching the carbureter or are allowed to dissipate themselves within a chamber within the waterjacket. The provision of such a chamber has already been referred to in connection with another phase of carburetion, but it also applies here. We know that certain critical lengths of inlet pipe are best in practise and one is often asked to explain why the lengthening or shortening of a certain pipe has led to improved results. The explanation is that there is probably some critical wave length in the pipe in question at certain engine speeds which causes great fluctuation of pressure.

With the modern perfection in carbureter design, it is very often probable that as the mixture leaves the carbureter it is fairly homogeneous, but owing to the pulsations taking place in the inlet manifold, the mixture as it reaches the various engine cylinders may vary considerably in richness. At the carbureter outlet the succession of engine impulses will produce a fairly uniform flow of carbureted air, but this can scarcely be said to be true in the manifold itself. Owing to the inertia of the gases along the pipe, there is always a tendency for the heavier particles of gasoline vapor to drive toward the ends of the pipe,

causing very slight and instantaneous variations of pressure in the mixture.

Certain periods in the working of an engine must occur when the pulsations of the mixture in the inlet pipe synchronize with the periodicity of the pipe itself, thus tending to upset the carburetion to certain engine cylinders. Under these conditions, pressure waves are set up, due to the impulses of the mixture on its way to the various cylinders, and for this reason it is necessary, in special cases where carburetion is of very great importance, to keep the mixture flowing in one direction only, and not allow reversals of flow in the mixture stream to occur.

It is noteworthy that considerable improvements in carburetion, particularly with six-cylinder engines, have been made by eliminating the induction pipe entirely, and coring the inlet passages within the cylinder castings. This may be accountable for by two reasons, one being that heat is added to the mixture during its rapid circuit from the carbureter to the engine; and the other being, that the passages cored through the engine itself are generally of considerable magnitude, so that the surging flow is thereby much reduced.

There is no doubt that if an inlet pipe be made of sufficient size, and that enough heat is supplied to it to prevent condensation of the vapor in the pipe, local variations of pressure will be reduced to a minimum. In one particular case of a six-cylinder engine which had been difficult to carburate with a certain type of carbureter, the redesign of this engine with the inlet pipe eliminated, and the incoming charge carried through cored passages, entirely overcame the previous carbureter difficulty.

The modern tendency to place not only the induction manifold but also the mixing chamber within the cylinder waterjackets undoubtedly tends to improve carburetion by reason of the facilities such an arrangement gives for suitably heating the fuel vapor.

Can Vary Intake Pipe Diameter

It has been an axiom in the past that the area of the inlet pipe between the carbureter and the valves should not undergo any great change in dimensions on account of the drop in velocity aggravating precipitation. In modern practice, however, when a drop in velocity is permitted and hot walls are presented, any liquefaction of vapor or precipitation of suspended particles is suitably met by hot surfaces.

Furthermore, a manifold of considerable capacity tends to damp out all those pressure variations previously referred to and equalize out the suction as the carbureter jet.

Reverting again to the question of inertia and the difference between that of the fuel and that of the air in a carbureter system, we must not confuse the vapor with the liquid fuel. If all the fuel is vaporized in the carbureter and properly mixed with the air, although the vapor density is about three times that of the air, the maximum variation in the volume of fuel vapor is only between 1.2 and 3.2 per cent. (Dr. Watson) of the volume of the air. However, if the fuel is only partly vaporized fuel is carried in suspension, and it is from these suspended liquid particles that difficulties occur.

Dr. Watson in his experiments upon a four-cylinder, four-cycle motor made some interesting indicator measurements of the pressures on the induction pipe at different speeds of engine rotation. He showed that at a speed of 656 revolutions per minute the pressure at the movement of inlet valve opening, namely, 20 degrees late, was slightly above atmospheric and continued to rise even after the valve had opened, due to the inertia of the mixture in the pipe. As soon as the valve opened appreciably at a crankangle of 45 degrees, the pressure fell to atmospheric and rapidly dropped to a minimum of 1.3 pound per square inch, where it continued until at 150 degrees crankangle it was at 1 pound per square inch. At the moment of valve closing, namely, at a crankangle of 200 degrees, or 20 degrees late, the pressure had risen to slightly above atmospheric.

Effect of Speed on Pressure

When the engine speed increased to 860 revolutions per minute the pressure at valve opening was down to 0.4 pound per square inch, with a maximum depression of 1.8 pound per square inch and rising to 0.3 pound per square inch at valve closing.

At a speed of 1,200 revolutions per minute the corresponding pressures were 1.2 pounds per square inch at valve opening; maximum depression 2.3 pounds per square inch, and 1.2 pounds per square inch at valve closing.

From the following table it will be seen that the pressure in the induction pipe at the moment of valve closing is above mean pressure:

Speed Revolutions per Minute.	Mean Pressure Lb. Per Sq. In. Gauge.	Pressure (Gauge) at Moment of Valve Closure Lb. per Sq. In.
656	—0.9	+0.1
860	—1.2	—0.4
1200	—1.7	—1.2

This engine can scarcely be taken as an example of modern design on account of the apparent smallness of the valves which have caused the wire drawing. The area through the carbureter was also probably a good deal less than would be the custom in modern practice where a sufficient area is provided to permit engines to attain speeds of 2,500 revolutions per minute in normal working.

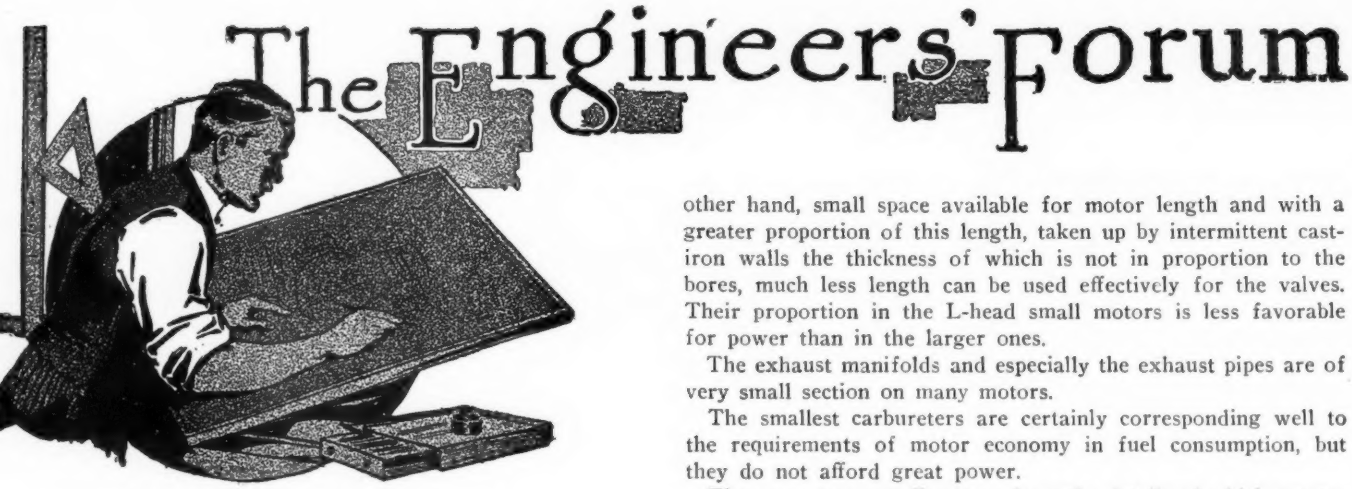
In Dr. Watson's engine the volumetric efficiency varied from 78 per cent. at 500 revolutions per minute to 63 per cent. at 1,300 revolutions per minute, which can scarcely be considered good. These values could easily be brought up to 90 per cent. at the lower speed and 80 per cent. at the higher by suitable design.

Carbureters Blamed for Faults Belonging to the Feed System

SO long as the gravity feed system for taking the gasoline from the main tank to the carbureter float chamber is still used, for reasons of economy of construction, instead of the pressure system by which the exhaust gas or slightly compressed air is employed for this purpose, there will be numerous occasions when the carbureter will not operate properly simply because the amount of gasoline which flows into it is insufficient and is used up by the motor faster than it can be supplied. While the driver stops to investigate the trouble the float chamber fills up, and when he thinks he has found the trouble—somewhere else—and starts up again, the motor starts normally, only to languish or fail in the same manner a little later if the causes of the failure continue to act. A new investigation brings the same result, and thus the driver is likely to remain unaware of the true cause. It is, of course, usually when driving in the mountains that this happens, as it is on the grades that the motor works hard and the difference in the levels of the main tank and that of the carbureter becomes too small to afford the needed pressure. The trouble is very much aggravated if the fuel piping is so fine, as it frequently is, that the skin friction in it further reduces the pressure.

With low-built cars it is necessary to mount the carbureter high on the motor to have it accessible—which is, any way, the better practice—and this still further reduces the difference in levels. The pressure system thus makes for accessibility.

Another advantage of the pressure system is that it keeps dirt out of the gasoline, because the latter must rise from the low-hung tank and leaves the dirt behind, to be drained off. In the matter of safety from fire it is also far superior, as a leak in the main tank allows the fluid to drop directly upon the ground, while a similar leak in a tank placed high enough for gravity feed spreads the fluid over the chassis.



French Small Motors Through American Eyes

Detroit Engineer Criticises New European Designs—How Large Valves Are Obtained—Improvements of the Year

By Eugene P. Batzell

DETROIT, MICH.—Editor THE AUTOMOBILE:—The motors exhibited at the recent Paris Salon revealed one notable development; namely, the prominence of the small four-cylinder type. On the other hand, contrary to expectations, this type and many of the larger motors do not present many interesting novelties in the matter of obtaining a forced motor, or one which is characterized by a big power development for its size. The progress during the last year has been practically at a standstill in this direction because only well-known constructive means are used in those motors which one is justified in classifying as the forced type. The fact is, that many makers of the smaller cars do not try to convey the impression to the public that their cars are equipped with forced motors. There are some who do make statements to that effect, but the examination of their motors often reveals the absence of any particular characteristics of the forced type. It is an unquestionable fact that the small French four-cylinder motors of the 50 to 75-millimeter-bore size is no forced type. The dimensions of parts and the performance of the cars—all indicate the above, a vehicle speed of 60 kilometers per hour on pavement is claimed with the smaller bore motors and up to 70 kilometers with the larger of the above set limits, which cannot be considered as a wonderful performance indicating the presence of a forced motor. There are some special exceptions, but in the somewhat larger cars with larger motors. The makers even give in frankly that their light cars could not be controlled at a higher speed; consequently, the utter uselessness for larger, faster and more powerful motors. Nevertheless, the present state of such small four-cylinder motors is highly commendable. This class of French motors is really a decreased copy of the larger famous models, with alterations in the proportions of some parts, which have taken away from them the character of an extra powerful model.

To explain the latter statement, one can mention the forced lubrication even in the small motors, which is certainly a desirable but expensive one retained from the large motors. On the other hand, small space available for motor length and with a greater proportion of this length, taken up by intermittent cast-iron walls the thickness of which is not in proportion to the bores, much less length can be used effectively for the valves. Their proportion in the L-head small motors is less favorable for power than in the larger ones.

The exhaust manifolds and especially the exhaust pipes are of very small section on many motors.

The smallest carbureters are certainly corresponding well to the requirements of motor economy in fuel consumption, but they do not afford great power.

There are some small motors from the details of which greater power development could be reasonably expected if everything else would be proportioned right. For instance, a small T-head motor affording ample valves is to be noted as a step forward, but the subsequent choking of the exhaust gases in a small exhaust pipe certainly takes away much of the power and speed gained by the larger valves. Another motor of the L-head type has valves for each cylinder crosswise to the crankshaft, as shown in Fig. 1, representing the plan views. These valves are operated from a single camshaft by means of rockers.

Although satisfactory valve sizes are obtained thus, the exhaust is carried away by a very small exhaust pipe A and a very small carbureter C as indicated. The old method of placing one valve in the top of the cylinder is also represented in some instances but on every case the valve-operating mechanism is completely inclosed which is notably a contrast to the American means of overhead-valve motors generally exposing at least the push rods.

Small Valve Caps a Feature

Aside from the above mentioned relation of the small motors as the forced type, the following characteristics can be of interest. A great majority use no intake manifold whatever, the carbureter being joined directly to the cylinder block, stating either on the valve side or, more often, on the side opposite to them. A horizontal Zenith type of carbureter is used very frequently. A very neat appearance is presented by the small valve caps on top of the cylinder blocks but a more practical arrangement can be seen in one single large plug covering the intake and exhaust valves at the same time. The oil reservoir is frequently mounted elsewhere than in the motor under pan, which is necessitated by the generally low build of the car, the medium length of stroke employed and consequently inadequate space left for this reservoir on account of road clearance.

The motor cooling is chiefly by the thermo-syphon system in some instances connected with very spacious radiators. Invariably one uses single ignition by magneto.

The pistons and connecting rods are made with the intention of lightness, but they are not shortened excessively, rather being made of thinner material. They retain liberal bearings. On account of the support and for length, those using water circulating pumps generally mount them ahead of the front-motor gearcase because the magneto alone has just enough room between the motor supports. There can be seen some cross shafts, but they are not prominent in this class of motors. A rather novel arrangement is seen in one case where the starting handle operates on the motor camshaft and the magneto is being driven at the front crankshaft end. The small motors are mostly suspended on subframes and are not built in unit power plants.

The large valves in L-head motor construction are characteristic. The required length of space for their placing is acquired by building the cylinder blocks much longer across the valve bore than across the cylinder bore. This is illustrated in

Fig. 2, representing the plan view. One sees also the Adler arrangement with offset valves, Fig. 3. Many motors are built with inclosed valves, which is intended for a better shaped combustion chamber in connection with fewer heat losses and also affording a somewhat better gas passage through the valves into the cylinders. This arrangement is particularly valuable in the long-stroke motors as it permits of bringing the valve heads much closer to the cylinder bore without causing interference between the crankshaft, which latter can be placed far enough from the motor center line to clear the former.

Overhead Replace T-Head Design.

Some cars, notably the Hispano-Suiza, which already have been known for their extra good motor performance, have gone a step further toward still more powerful and efficient motors, as they claim, by adopting the overhead valve construction replacing the former T-head type. In this instance the overhead construction is remarkably well and thoughtfully developed. The large motors, as well as the small ones, very seldom make use of any exterior inlet manifold, retaining merely the passage cored in the cylinder block; the latter, by the way, being universal for the four-cylinder type. Motors are frequently carried on subframes, of which there are some original designs. The thermo-syphon system of water cooling is frequent with very large radiators as a rule. Similar large radiators are used also with pump circulation, but the pump sizes, and the connecting pipes, are very small in comparison to those which one is used to see on the American cars. Force-feed-oiling systems are used, as a matter of course, for crankshaft and connecting-rod bearings. Subframe suspensions are frequent, with a few unit power plants and three-point suspensions.

Why Moline Adopted Knight Motor

By W. H. Van Dervoort

President Moline Automobile Co.

MOLINE, ILL.—Editor THE AUTOMOBILE:—Following our Moline-Knight announcement scores of letters have come to us from engineers, technical students and laymen asking the reason why we adopted the Knight-sleeve-valve type of motor after 9 years' success with the old poppet-valve type. In a nutshell the answer is: "The Knight motor represents progression."

The things of yesterday will not satisfy us today. We are all on the lookout for something better, whether it be in motor-car construction, wearing apparel, 3-cent fares, etc.

So it has been with the adoption of the Knight motor. This type was not adopted by the Moline Automobile Co. until we had been assured by the experience of other makers and by exhaustive tests in our own shops, that the Knight was more powerful, more flexible, more ecoı omical and more silent than the poppet-valve design.

If great power and high speeds are desired in the poppet-valve motor, high compression, large valves, strong springs and precipitous cams are employed. This high power and great speed often produce an uncontrollable, noisy and unreliable motor.

The large valves and their seats are very susceptible to warping; because of their large area and with the increased heat of high compression they do not cool properly, and the strong springs necessary to seat them at high speed soon weaken or actually pound the head of the valve out of shape. This spring action, seating with a force sometimes as great as 300 pounds pressure, has the same effect when the valve is red-hot (as it becomes under hard work) as pounding the head in the center with a hammer, as the large head yields in the center where the sprnig is pulling through the stem, the clearance between valve tappet and cam decreases, the timing undergoes change, and adjustment is necessary to bring back the decreased power. To remedy this defect racing motors are often built with two exhaust valves to the cylinder, so they can be kept small and cool.

In order to produce a quiet, reliable poppet-valve motor, low compression, small valves, weak springs, and a gradual opening cam are necessary on account of the difficulties as enumerated. With small valves and weak springs go decreased efficiency, both in the matter of power and fuel consumption. The small valves do not admit sufficient gas to generate high pressure behind the piston, and the weak springs will not properly seat the valves at high speeds, but cause them to lag and foul the mixture by permitting the piston to draw back into the cylinder exhaust gases through the exhaust ports when the spring fails to close this port at the proper time.

Sleeve Valve Type Unaffected by High Pressure

The superiority of the sleeve engine over the poppet valve lies in the fact that the efficiency and durability of the sleeve-valve system is not affected by high pressures. The sleeve valve is balanced against lateral pressure, and the explosion does not affect or shock it at any point. The ports are large, the inlet and outlet most effective for their area, and the action of the motor is not affected adversely by their increased size. Increase of compression up to the pre-ignition point is no disadvantage, because the explosive pressures developed are expended in useful work upon the piston and the valves are no more difficult to open under high pressure than low.

In the sleeve valve, therefore, it is possible to combine the advantages of both types of poppet-valve motors. In the sleeve valve is combined the silence, endurance and reliability of the small poppet valves and low compression with the high efficiency of the high compression, large valves, powerful springs and precipitous cams of the racing poppet-valve motor, and the operator has in the one sleeve valve all the advantages of both types. A standard sleeve-valve motor is capable, so far as efficiency is concerned, of delivering all the power of the racer with all the softness and quietness of the inefficient poppet-valve motor, and the operator has within his control a surplus of power which he can call into service when needed in emergencies. Of course, with standard bodies, wind resistance and weights of touring cars, nobody expects extreme racing speeds upon country roads, but the power is there when required for acceleration and hill work, as thousands of users testify.

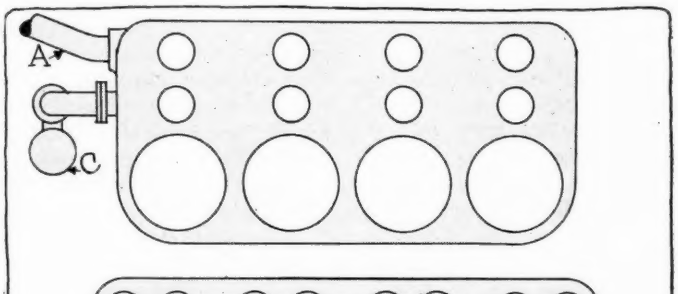
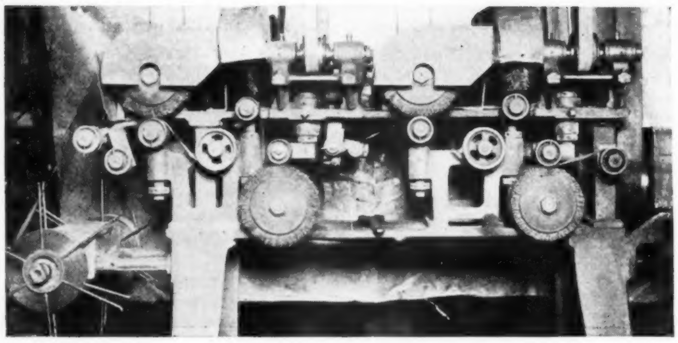


Fig. 1—Top—L-head motor with valves placed transversely
Fig. 2—Middle—Large valves in L-head type require wider space
Fig. 3—Bottom—Adler arrangement with the valves offset



The Rostrum

Carbureter Makers Discredit Idea That Moisture Increases Power

EDITOR THE AUTOMOBILE:—I agree with the notice by Mr. S. W. Rushmore on the effect of moisture in the atmosphere. It is plain that you cannot get any power out of water; it may help if the engine is designed for it, but, as to whether or not a small quantity of moisture, present in the atmosphere, has any effect on the motor, I am not ready to express an opinion. I, like almost every driver, have been, toward the close of the day, in such a mood as to think that my motor was running better than at noon but I would require more than this very slight impression to venture an opinion and I should not be surprised to find that it is another of these illusions which are dispelled when they are subjected to the light of measuring instruments. The great English scientist and philosopher, Lord Kelvin, said, "One knows only what one can express in numbers."

This reminds me of some tests made in order to test whether one accelerates a car quicker from very low speed by stepping suddenly on the accelerator pedal or by opening it a little more gradually. I made tests with a very light car, and, as I had an opinion in the matter and did not wish to rely on my biased sense, I had an accelerometer on the car, and it showed conclusively that the acceleration is the same.

DETROIT, MICH. E. R. HEFTLER, Zenith Carbureter Co.

Editor THE AUTOMOBILE—I agree with Mr. Rushmore with the exception that pre-ignition mentioned in this article is not the correct term. In my opinion this is a very much misused expression. The expression, quick ignition or rapid ignition would express what really occurs more thoroughly. From our experience we have come to the conclusion that about the only benefit derived from moisture in the charge is that of making the motor run more smoothly and permitting the spark to be advanced to its proper point without causing the motor to pound. It is also true that when using moisture in the charge the vibrations of the motor are considerably less. According to our theory, what the moisture really does is to absorb the heat directly generated by the compression of the charge during the compression stroke, thereby retarding the speed at which the charge will ignite. This ignition speed seems to be in direct proportion to the pressure of the charge at the time of igniting same.

There is another action which might have some bearing on this subject, that is, the fact that the water expands to a certain extent, in its travel from the carbureter to the cylinder, and displaces a certain amount of air which is charged with oxygen, thereby retarding the speed at which the charge will burn.

The two largest factors which determine the rapidity at which a given charge will burn are the pressure per square inch of the charge at the time of ignition, and the amount of oxygen in the charge. To develop the maximum power from a given size motor it is necessary to have the maximum pressure period on the piston head at the time of the crank throw being 90 degrees from the center of pressure, consequently any means whereby an imperfect motor will be brought to accomplish this result would give an increase of power.

I claim, therefore, that if a motor is properly designed and constructed there is nothing to be gained by using moisture in the charge.

INDIANAPOLIS, IND. RAY HARROUN.

Reader Gives Specifications of Ideal Automobile

Editor THE AUTOMOBILE:—The following specifications and Fig. 1 comprise my idea of the 1914 automobile. The frame should be pressed alloy steel, heat-treated; the springs, semi-elliptic 38 inches long on the front and should be three-quarter elliptic, 50 inches long on the rear. The front axle should be an I-beam, solid forging. A wheelbase of 132-inches would be desirable for easy riding, while the tires should be demountable types 36 by 4.5 front and rear. The motor should be about 45 horsepower, four-cylinders, with large inclosed valves, and a bronze crankcase. Bosch two commutator magneto, a Rayfield carbureter and Bosch plugs should be used. The motor should have a self-contained oiling system, a gear pump that forces oil from the reservoir to bearings in constant stream.

A honeycomb radiator with a gear-driven pump, a multiple-disk clutch, and a four-speed selective type transmission with a bronze gearcase. A worm gear type steering gear should be used also. All brakes on the rear wheels, and radius rods which relieve the rear axle of all driving and braking stresses. It should have an electric self-starter and electric lights. The starter and lights should be run off of a storage battery charged

by a dynamo on the motor. A two-passenger would be my choice, the gasoline tank to be carried in the rear and having a capacity of 30 gallons. The extra tires should be carried in the rear. The equipment should include a Klaxon horn, a Warner speedometer, a motor-driven pump on the transmission shaft for tires, and a gasoline gauge on the dash. The speed of this car should be about 60 miles an hour and the price about $4,300.

Kansas City, Mo. RALPH CURTISS.

Buick as Stationary Engine

Editor THE AUTOMOBILE:—A few days ago I bought a 1908 model Buick touring car, of which the engine seems to be in fair shape, provided it is overhauled. I intend to use this as a stationary engine for driving a 60-volt, 25 ampere, 1.5 kilowatt generator for a private lighting plant, and also for other power purposes.

1—One of our garage experts informs me that it will be necessary to equip the engine for such purposes with a governor in order to insure a regular speed. It seems to me, however, that the flywheel and the throttle would control the speed perfectly and would like to have your advise upon this subject.

2—Would the fuel consumption be much out of proportion for the power required in comparision with a one-cylinder, 3 horsepower engine, which will run this generator perfectly?

3—In this type, the engine and transmission are integral parts and the flywheel is attached to the front end of the engine. On account of the oiling system, which has a forced feed with pipes running into engine and transmission, would it be possible to separate these units or is it better to leave it all together?

4—For stationary purposes, would you advise to use the regular radiator, or let the cooling water run through a larger receptacle instead and is it necessary to leave the fan on the engine?

Platte, So. Dak. C. VANDERBOOM.

—1—Your motor will require a governor, because with any given throttle setting, the speed will vary more or less as the load. A lighting circuit requires a fairly constant voltage because slight variation in voltage will make a large difference in the candlepower of the lamps, so it is not only necessary to equip your motor with a governor but with one that will not allow speed variation of more than 2 or 3 per cent. one way or the other. The governor may be driven by a belt on the flywheel.

2—Generally speaking the efficiency of a motor and therefore its fuel consumption, which depends directly on the efficiency, is greatest somewhere near the maximum output of the motor. For this reason the 3-horsepower, one-cylinder stationary engine you mention would be much more economical for driving a generator of 1.5 kilowatts or about 2 horsepower capacity.

If you use a 20 or 30 horsepower automobile motor to drive a generator of a maximum capacity of 2 horsepower, you will have a fuel consumption entirely out of proportion to the power developed. The economy of a gasoline motor, or any internal combustion engine for that matter, depends, other things being equal, on the compression; when the throttle is nearly closed and the compression is low the consumption of fuel will be high. Therefore it is desirable to run this motor with wide open throttle when the full load of 1.5 kilowatts is being carried but in order to do this and still not generate more power than can be used it will be necessary to run the motor at the slowest speed possible.

3—Unless you can put this gearset to some other purpose, it might as well be left where it is, although if you want to remove it it will not interfere with the oiling system to do so, providing you plug up the oil pipe running to the gearbox.

4—The simplest cooling system for a stationary engine would be to connect the inlet pipe on the water jacket to the city supply, and the discharge pipe to the sewer, allowing just enough water to run through the system to keep the water from boiling when the engine is running under full load. While the consumption of water is small with this scheme, yet conditions may be such that it will be found undesirable. In this case, a simple and satisfactory cooling system based an the thermo-syphon system can be installed by connecting the inlet and outlet water pipes to a tank holding about two barrels of water. This tank should be located above the motor, the inlet pipe running to the bottom of the tank and the outlet pipe to some point near the top, but always under the surface of the water.

Information on Gear Ratios

Editor THE AUTOMOBILE:—1—Do wire wheels require any more attention and care than the usual type artillery wheels?

2—Is there a likelihood that rust will attack the parts of the spokes where they cross each other?

3—My car has 32 by 3.5 inch tires on wooden wheels, and is geared 4.16 to 1, direct on high and I am thinking of using 34 by 4 wire wheels. Would this effect the gear ratio?

4—How would it compare with another car of the same type geared 3.65 to 1 with 32-inch wheels.

Wilkes-Barre, Pa. DR. F. P. ARCHER.

—1—Wire wheels are more difficult to clean due to the great number and small size of the spokes, but in other respects they require no more attention than wooden wheels.

2—In modern wire wheels the spokes do not touch where they cross each other, so therefore there is no possibility of the spokes chafing and rusting at these points, although when these wheels were first introduced some difficulty was experienced on account of the spokes rubbing together. Another source of trouble was due to the rusting of the spokes where they were fastened to the rim, but this was overcome by careful enameling.

3—By fitting 34-inch wire wheels in the place of 32-inch wooden wheels, the speed of your car would be increased about 6 per cent. This result is arrived at by simply taking the ratio of 34 to 32, which is 1.06.

4—With 34-inch wheels and a gear ratio of 4.16 to 1 the rear wheels will travel 2.14 feet for each revolution of the driveshaft, while with 32-inch wheels and a gearing of 3.54 to 1, the corresponding travel will be 2.3 feet, so the latter combination gives the higher gearing.

Wants to Lengthen Stroke

Editor THE AUTOMOBILE:—1—Will you please tell me whether it is possible to lengthen the stroke of an engine and whether the increased power and efficiency of the motor would justify the expense. My motor has 4 by 4-inch stroke and bore, and I have thought that I might increase the stroke 1-2-inch, 3-4-inch or possibly 1-inch by inserting a bushing between the crankcase and cylinders, then increasing the length of connecting-rods and valve tappets. Would this necessitate any changes in the timing of valves, or in the gears or gear ratio? Would this not increase power and speed of car, especially on hills, if the gear ratio is left the same? 2—I would also like to know if the play in the differential on this car can be taken up to eliminate the hum that has developed lately.

Spokane, Wash. A NOVICE.

—1—Your suggestion to lengthen the stroke of the motor by putting in a bushing between the crankcase and cylinders, will not work because the stroke of the motor depends on the throw of the cranks, in other words it is equal to the diameter of the

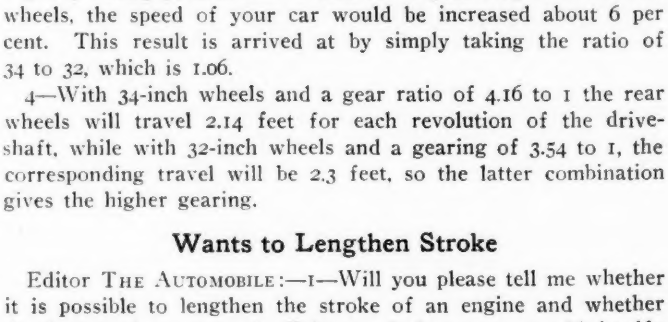


Fig. 1—Reader's ideal automobile with streamline body, 45 horsepower motor and four speed gearset

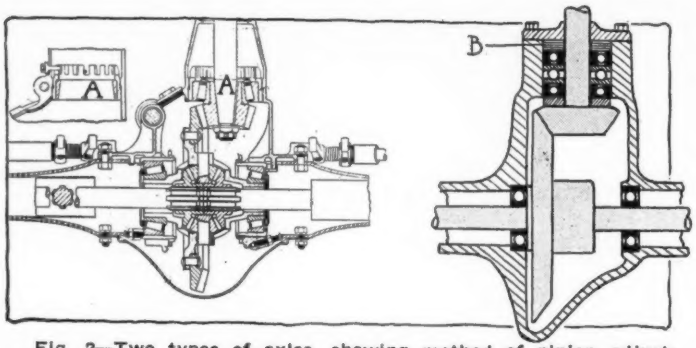


Fig. 2—Two types of axles, showing method of pinion adjustment. At the right, adjustment is obtained by inserting shims at B, and at the left turning up on the collar A. Collar locking pin is shown at extreme right

circle described by the crankpin and this is twice the crank throw or radius, so in order to change your stroke you would have to fit a new crankshaft with throws of larger radius. In connection with this change, it would also be necessary to put a bushing between the crankcase and cylinders or in some other way lengthen the distance between crankshaft center and cylinder head, in order to provide for the increased travel of the piston due to the longer stroke.

2—The hum in your differential is due to the wearing of the teeth and may be stopped by setting the bevel pinion a little closer to the large bevel gear. The means by which this adjustment is effected varies so greatly on the different cars that we cannot tell you exactly how to go about removing the play in the gears in your car, but we will describe how the adjustment is had on two different types of axles and this will probably show you how to fix your car. The two axles are illustrated in Fig. 2. At the left is shown an axle in which the rotating parts are mounted on roller bearings and in which the bevel pinion is set closer to the gear by turning the sleeve A to the right. This sleeve is treaded in the housing and by turning it as indicated it pushes the gear forward into adjustment.

Another type of axle is shown at the right. In this, adjustment is obtained by inserting shims back of the pinion as indicated by the letter B. These shims are nothing more than thin sheets of copper that are cut to fit over the pinion shaft, and should be added one by one until the gear is forced forward into proper adjustment. In any case be careful not to adjust the gears too tightly, but just bring them close enough together to remove the play.

Before you go to the trouble of adjusting the pinion it would be well to see that the hum is not caused by lack of lubrication.

A Loose Bearing Knock

Editor THE AUTOMOBILE:—I have my second Ford car, bought last March, and have driven it nearly 7,000 miles. For the past 6 weeks it gets a knock or thud. This occurs when the engine is pulling and running perfectly. Unless I shut off gasoline and change to low speed immediately, the car will stop. The engine is free from carbon, the valves and plugs are all right, and in all the time I have driven a Ford car, I have never had this kind of trouble. It reminds me of a wheel revolving in space and striking some object to check its force.

Shreve, O. CARL BROS.

—Judging from the description of your trouble, we would say that the knock is caused by a loose bearing, especially in view of the fact that you have driven your car 7,000 miles. This is the most probable and most frequent source of knocking trouble, but before inspecting your bearings, we suggest that you make sure that it is not due to some other difficulty. The knock may be caused by improper lubrication, incorrect mixture, a deranged cooling system or driving with the spark too far advanced.

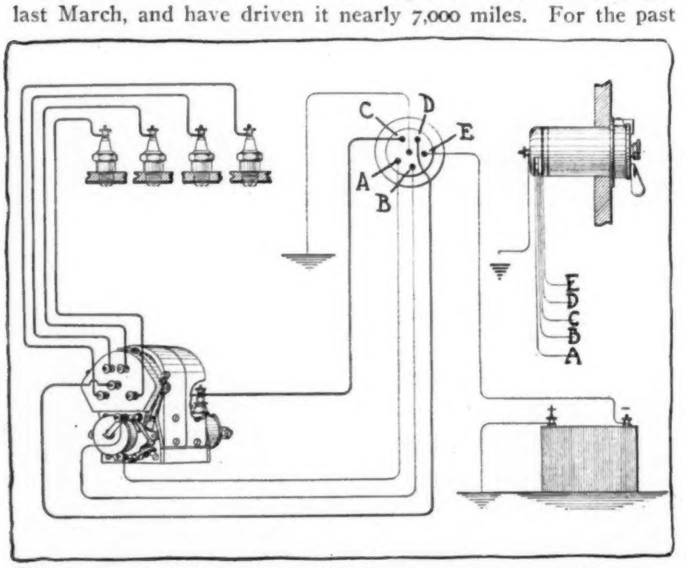


Fig. 3—Bosch dual system. High tension wires are indicated by the heavy lines

Changing to Bosch Dual System

Editor THE AUTOMOBILE:—I have a model G 1910 Franklin equipped with a Bosch DU-4 magneto and would like to add batteries to the car to facilitate starting.

Will you kindly state whether batteries can be applied to the car without changing the magneto and if so, what is the "modus operandi" and expense incidental to same?

Pearl River, N. Y. S. H.

—Your magneto can be changed so as to enable you to install a dual system by substituting a double breaker for the single breaker that you now have on the front of it. The extra breaker is for timing the battery current and is used in connection with a coil located on the dash. The wiring arrangements for this dual system and an illustration of the double breaker are given in Fig. 3. The dual system requires four connections between the magneto and the switch which is incorporated in the coil on the dash. Two of these are high-tension and two are low-tension. Wire C carries the high-tension current from the magneto to the switch contact, while wire D is used to transmit this current from either the magneto or the coil, to the distributer. The conductor A transmits the low-tension battery current from the primary winding of the coil to the battery interrupter. Low tension wire B is the grounding wire by which the primary circuit of the magneto is short-circuited when the switch is thrown to either the off or battery position. Connection between one terminal of the battery and the coil is had through a wire E, and the other terminal of the battery is grounded. In order to make this change it will be necessary to return your magneto to the Bosch factory. The charge for doing this work will be about $27. This price assumes that the parts removed from the magneto are in good condition and is exclusive of any repair work that may need to be done on the magneto.

Balancing a Four-Cylinder Engine

Editor THE AUTOMOBILE:—You have known of automobile engines that lost their balance, in spite of the fact that the weights of all moving parts are practically the same after the engine has been used for some time as when new. It seems rather paradoxical but is a fact nevertheless, and the evident reason is that while the car is new and all joints are nice, snug-fitting mechanisms the vibrations are barely perceptible, if at all. The vibrations are rigidly snubbed. But it usually does not take long for engines that are considerably out of balance to shake themselves loose from their fastenings and annoyingly proclaim their condition.

It was just such a four-cylinder motor that recently led me to think that the engine didn't like the rest of the car and wanted to get out.

I believed I was stuck at first, never having had any experience with the elimination of vibration. Here was something completely invisible, and it seemed uncomfortably technical. I admitted that it looked bad and would not be surprised if the ailment was incurable. Of one thing I was quite certain—that pistons and connecting rods should be of equal weight.

Where they are of equal weight the balance is as close as can be made without the use of balance slugs in the flywheel or balancing disks. I therefore determined that I would at least weigh the pistons and connecting rods, and if they proved to be O. K. I would throw up the job.

As soon as I had the parts disassembled I weighed the pistons with a spring balance, Fig. 4, and found that one weighed 5.25 pounds, and that all of the others were slightly heavier. The balance was not graduated closely, but I am convinced that the heaviest piston was 4 ounces heavier than the lightest.

I then assembled the connecting-rod parts and weighed the two ends by means of spring balances, Fig. 2. There was no perceptible variance in the weights of the connecting rods. If there had been, I don't know just what I would have done outside of drilling a few holes at points where strength would not be affected in order to reduce weight. It wouldn't be so simple to add weight had one end proved light. In such an event I would perhaps have moulded on a piece of babbitt metal.

It was evident that the pistons could be improved. I looked them over carefully and concluded that some superfluous metal could come out of the interiors of the heavier pistons. Anyway, reciprocating parts should always be made as light as possible, consistent with strength. It was a simple matter in this case to place the pistons in a lathe and bore away from the interior, Fig. 4. I computed the reduction in weight necessary in each case and carefully caught all cuttings as work was in progress. As soon as the aggregate weight of the cuttings equalled the reduction desired I knew that the piston then weighed exactly 5.25 pounds.

After finding the discrepancy in weights I was almost certain of some improvement in the balance of the man's car, but I was even more successful than I had hoped to be. After replacing the pistons and connecting rods I tried the engine without tightening up the bolts that secure it to the frame. It was vastly reduced. And after tightening the bolts the vibration was almost imperceptible.

New York City. W. F. Schaphorst.

The Cause of Back Firing

Editor The Automobile:—We have learned that a lean mixture in the carbureter causes back firing. Will you please give a scientific explanation? How is the mixture ignited?

Thomaston, Conn. W. L. Douglas.

—A lean mixture will cause back firing because it burns so slowly that it is not entirely consumed by the time the inlet valve opens and so the flame sets fire to the incoming charge and causes an explosion in the intake manifold. With any inflammable mixture such as air and gasoline, there are certain proportions of these two elements that will give a maximum speed of flame propagation and when the proportion of these elements is changed there is a corresponding decrease in the rate of combustion. So, as the mixture of gasoline and air becomes weaker and weaker the rate at which the charge burns becomes slower and slower until finally instead of just taking a fraction of the power stroke it takes the whole of it and also all of the exhaust stroke as well, so that when the inlet valve opens the flame from the slowly burning charge sets fire to the mixture in the manifold.

Magneto for Two-Cylinder Buick

Editor The Automobile:—I am the owner of a Buick model F car which is in good condition all around. As I am using dry batteries as a current source which causes annoyance at times, I am thinking of installing a high-tension magneto, if this can be done. Will you kindly advise me what magneto to buy and how to attach and gear it? Also give plan of wiring when dry batteries are used for starting.

Iowa Park, Tex. Horseless.

—The Automobile cannot advise you as to what make of magneto to use, as this is a matter of policy and therefore is unable to give you the wiring diagrams you desire. The Buick model F car is a two-cylinder machine and so a magneto can be easily installed by placing it on the crankcase cover. Drive for the magneto is taken from the camshaft gear and in order to connect up this gear with the gear on the magneto, it will be necessary to cut a piece out of the gear housing. The magneto, itself, is fastened in place on the top of the crankcase by bolting.

Cold Motor Hard to Start

Editor The Automobile:—1—I have a 1914 Ford, and if I leave it out for 1 hour or more in the cold it is impossible to start it. Will you explain this to me? I presume it is because the commutator on the armature of the magneto is cold and until it has revolved fast enough to warm it it will not start. Do you know of any way to overcome the difficulty of starting? If you do not know any way of improving it I will put batteries in connection.

2—Kindly send me plan of wiring. Also I wish to install an electric lighting system. Which generator and battery would be best adapted and cost the least? 3—Would the Ford magneto make an efficient generator in connection with a transformer, and using the Bosch magneto for ignition? Would the Ford magneto charge the battery fast enough to make it a serviceable system? Would it pay to do this?

Providence, R. I. A Subscriber.

—1—Your motor is probably hard to start for the reason that it is so cold that the gasoline does not vaporize properly, and so an incombustible mixture is secured. By covering the hood

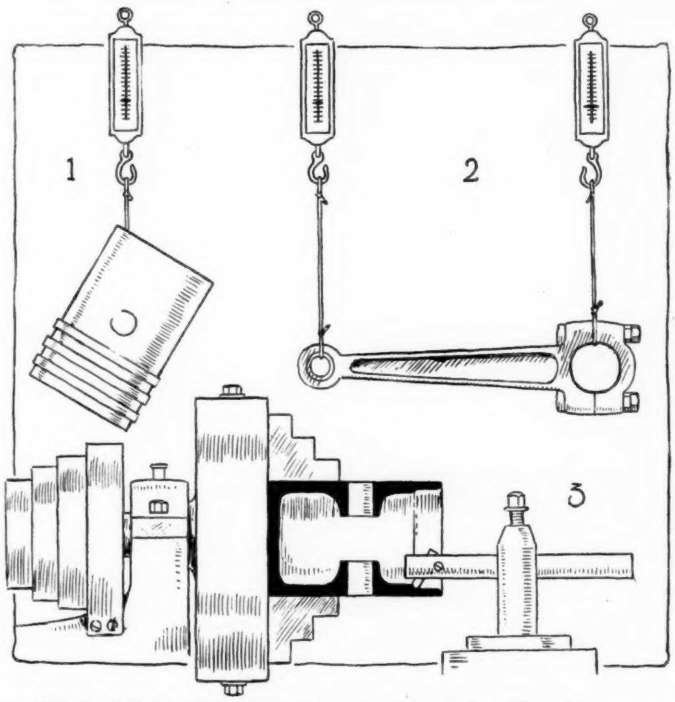


Fig. 4—Balancing pistons and connecting-rods. The pistons were brought down to weight by taking metal off the inside of the piston

and radiator with a heavy blanket whenever you leave the car outside the heat of the motor will not radiate so rapidly and you will find starting easier after a longer period than if it were not protected from the cold.

In order to start the motor easily when it is cold, first prime the cylinders with a little gasoline.

2—The Automobile cannot advise you as to what system to use and therefore is unable to send you wiring plans.

3—The Ford magneto generates an alternating current, while a direct current is required for charging the battery. Therefore, in order to use the Ford magneto for lighting purpose as you suggest, you would need some form of converter for changing the current from alternating to direct, and there is no such device adapted to automobile service.

The Engineering Digest

Friction Between the Spring Leaves a Small Factor in the Damping of Oscillations

SCIENTIFIC EXPERIMENTS WITH SHOCK ABSORBERS

AMONG the forces which act automatically to reduce the oscillations of vehicle springs, so as to bring them to their rest-position in time for the next shock which may be received and, generally, make them more suitable for their purpose, the friction caused by the gliding movement of one spring leaf upon another is usually looked upon as the most important one, says *Dr.-Ingenieur* Erich Bobeth in his work on "The Wasted Forces and the Spring Suspension of Automobiles," which was reviewed in two earlier issues of this journal. He describes and illustrates an apparatus which enabled him to ascertain the numerical value of the friction of the spring leaves in two automobiles which were at disposal for his experiments, and the same apparatus was used for ascertaining the actual damping effect of other factors of which no account is usually taken, but which are present in greater or lesser degree in all vehicles, and also for measuring the action of different types and models of shock absorbers. The experiments did not give the same variety of shock effects as would be sustained by a vehicle driven over a rough road, but none the less served to demonstrate some relations in the forces involved which are not generally known to exist and which have a direct bearing upon the design of springs, of shock absorbers and of certain features in the chassis. The results are expressed in curvograms in his book, but of these only one is reproduced herewith.

The shackle bolts were oiled and the spring leaves were coated with a light film of grease, and this condition was maintained throughout the series of experiments. It was found that the damping effect of the friction, including the friction of the shackle bolts in the total, was almost independent of the load.

As it is common practice to use a large number of leaves in the springs when it is desired to obtain a specially effective damping of the oscillations, the number of leaves was reduced successively from 8 to 5, 3 and 2, and it was shown that in fact the damping effect of the springs, again including the shackle friction, was substantially proportionate to the number of leaves. On the other hand, the damping due to this factor, even with a maximum of leaves, was subsequently found to constitute only a small portion of the other damping effects produced by other elements in the mechanism of the vehicle.

When the load was made to act obliquely upon the spring, causing some torsion, and consequently pinching among the leaves and in the shackles, the damping was very much increased, showing by analogy how important may be the effect of similar factors acting in other portions of the vehicle.

The Self-Damping of Vehicles

As just said, the damping effects of the springs and shackles constitutes only a small portion of other damping effects due to imperfections in the vehicle construction which cause relative movements of the construction members. This factor in its totality the author terms the self-damping of the vehicle. It varies greatly in vehicles of different type, being considerably larger with shaft drive than with chain drive for example, and it varies not a little as between two vehicles of the same identical model, being determined somewhat by variations in the fitting of parts, by the condition of maintenance and by the nature of the service the vehicle has given and the treatment which it has received on the road. Special arrangements were made to measure the self-damping under different conditions. The axle load was varied from 600 to 1,200 kilograms, the speed from 15 to 75 kilometers per hour and the power at the wheel rim from 5 to 20 horsepowers. Despite this wide range of variations the self-damping was shown to vary but little so far as these specific causes were concerned. The amplitude of oscillations also had small influence. The self-damping curve was found to be nearly a straight oblique line, expressing the damping in the number of millimeters by which the amplitude of the oscillations was reduced, the latter being marked on the abscissa.

Great importance is attached to the fact that neither the vehicle speed nor the power transmitted was found to have any sensible influence on the self-damping, as this assures the desired effect from artificial dampers—shock absorbers—when these are applied to produce a stronger and better regulated effect than that obtained by the self-damping action. It would not be well if such variable factors as those mentioned would interfere with the calculated effect of devices meant to improve the running and the suspension of vehicles under all conditions of operation.

In the case of chain-drive vehicles it was particularly ascertained that the use of high power, causing great stresses in the chain and chain-adjuster joints, did not increase the self-damping, which, as before mentioned, is low in this type of vehicle.

Conclusions for Designers

On this point Dr. Bobeth offers the following observations: "This dependence of the damping upon the design of the vehicle is of special significance. It may be assumed that also minor differences in construction have a considerable influence. Different methods of mounting the springs, transmitting the power and bracing the axle must give different values. Irregularities in the assembling, a misaligned spring leaf, a strut which pinches, may increase the damping effect notably.

"It is further to be considered that the experiments were conducted without departing from parallelism between the axle and the frame. With the oblique and cramped positions of the parts which occur on the road, the damping may assume uncontrollable proportions.

"The tests show that the self-damping depends upon a large number of factors beyond control and upon the momentary condition of the vehicle parts. It is therefore very difficult, not to say impossible, for the manufacturer to determine the self-damping of a vehicle in advance.

"The only means for influencing the damping of spring oscillations in one direction or the other with certainty of the result is to vary the number of the spring leaves, and the effect obtained by this means is very small in proportion to that determined by the self-damping of the whole chassis and running gear. The uncertainty of the spring action can therefore not be removed by that method.

"The problem of moderating spring oscillations suitably would therefore in view of these test results apparently be solved best as follows: By reducing the self-damping effects of the chassis to a minimum by all means at disposal and applying special devices between axle and frame in which the damping forces necessary for limiting the oscillations are produced under perfect control.

"In order to keep the damping arising from the spring leaves themselves as small as possible, it is needful to use as small a number of leaves as other considerations will permit, to have the rubbing surfaces smooth and lubricated, to use long shackles and, generally, to avoid any feature which might cause friction in the spring or the shackles."

Testing of Some Shock Absorbers

It was observed at the experiments for measuring the work done by shock absorbers that the duration of a large oscillation was practically the same as that of a small one. A diagram showing the moderating caused by a shock absorber with reference to the amplitude of an oscillation therefore also shows its relation to the rapidity of the oscillation.

With a simple device depending upon the friction between a strip of leather and a metal drum it might have been expected that the brake action would be proportionate to the oscillations, but the tests showed it to be somewhat progressive, making a straight oblique line in the diagram, and this is due to the fact that the lever by which the spring movement is communicated to the device overcomes the friction with a longer arm for a small than for a large oscillation. The action is, however, too strong for small oscillations, where no action at all is wanted, and not sufficiently progressive for violent shocks. The ease of adjustment is an advantage; also the compactness and simplicity, but the co-efficient of friction changes so rapidly that the need of adjustment becomes too frequent. The type specifically referred to is that shown in Fig. 1.

The second type examined was that shown in Fig. 2, which was devised by the Daimler company. Two annular metal disks are pressed against each other by a coil spring and are formed with wavy surfaces which fit together in the rest-position, whereas the waves of one are forced out of the hollows of the other when an oscillation takes place, thus forcing the coil spring wider apart the larger the oscillation. The action is markedly progressive, but the progressivity diminishes, while the brake action against small oscillations is undesirably increased, when the device is adjusted to a strong tension.

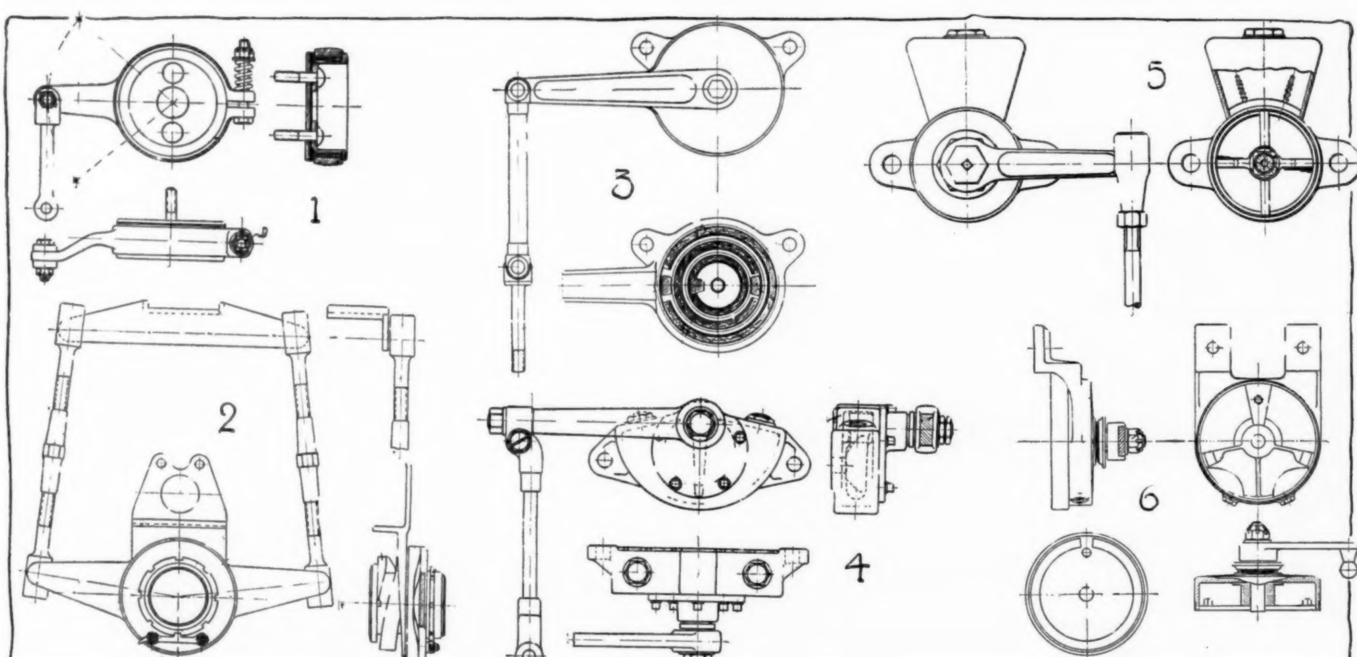
Another friction device, Fig. 3, in which three metal rings are successively set in motion in frictional contact with strips of friction fabric, showed a rapidly progressive action taking the form of an inclined S in the diagram.

The hydraulic shock absorbers Eclipse, Houdaille and Glissoire were tested. Their construction is indicated in Figs. 4, 5 and 6, respectively. It is characteristic of the type that the damping action produced follows regular laws and is readily subjected to modification by design and adjustment. The variable viscosity of the fluid employed varies the effect however. The three devices here in question gave simply a rapidly progressive action when used with the heavy oil intended for them. Valves in the blades of the Houdaille device intended to make the action more vigorous against the rebound of the vehicle spring than against their compression were ineffective at the speed at which all spring oscillations take place, but this shortcoming may have been remedied in later models. The same device has an oil reserve from which the working chamber draws a renewal of its supply by natural atmospheric pressure, as soon as a portion of the working oil is lost by leakage.

In the case of the Glissoire a test made with heavy cylinder oil, instead of the much more viscid fluid with which the device was originally filled, showed a considerable improvement. The sharply rising straight-line curve of the first diagram was transformed into a curve rising moderately at first—for oscillation up to 1 inch amplitude—and thereafter as rapidly as before. And at a third test, for which ordinary machine oil was employed, the shape was again more satisfactory, only in far more pronounced degree, while in both cases when the lighter oils were used the whole damping effect of course was considerably reduced. [The moral seems to be that it is easier to design and adjust the orifices for the oil movements correctly for a certain desired action with a view to the use of light oil than for semi-fluids, and that the lighter oil therefore should be preferable if proper provisions are made to prevent leakage as well as binding.—ED.]

Simplest of Hydraulic Absorbers

Prompted by the results of the tests with the hydraulic devices mentioned, the author designed and had made a simplified apparatus which is shown in Fig. 7 and which gave the diagram shown in Fig. 8. [The matter of leakage along the bearings of the piston rod was of course of no great importance for mere testing purposes, but it is evident that if these bearings were to be provided with fluid-tight packings the friction set up by the device would interfere more or less seriously with small spring oscillations as well as with large ones. The problem of keeping pressures away from the bearings which might leak or bind has apparently been solved now in some of the latest hydraulic devices, though not quite without attending disadvantages.—ED.]



Figs. 1 to 6—Shock absorbers whose manner of acting was tested and plotted by Dr. Bobeth

With this device the object was to obtain perfectly free spring action for small oscillations and rapidly rising resistances to large ones, and to this end the interior was shaped, as shown, with a large central portion in which the piston, being of considerably smaller diameter, would displace the oil without sensible resistance, and tapering toward both ends, so that in these the oil would have to be squeezed past the piston. In order to get a stronger effect against extension than against compression of the vehicle springs, the piston body was eventually adjusted to be below the center of the middle enlargement when the spring was at rest, this position being the one shown in the illustration. The diagram, Fig. 8, shows, however, the results obtained with the piston adjusted to start from a central position. The improvement of making it start from a lower position was not adopted until the device was tried out on the road.

The *a*-curve in the diagram indicates the test results with a heavy cylinder oil and the *b*-curve corresponding results with machine oil. The a_0-curve shows the share in the damping which was obtained by the friction of the vehicle spring leaves.—From Bobeth: *Die Leistungsverluste und die Abfederung von Kraftfahrzeugen,* 1913.

Remounting a Magneto After a Repair

IT is found that the average car owner has some difficulty in placing a magneto and its wiring in the proper relations to the cylinders of the motor after it has once been dismounted for one reason or another. The instruction usually given, viz., to open the cover of the distributer and take note of the position of the carbon hand with relation to the four connections before the magneto is taken down and not to turn the motor over till the magneto has been replaced, is frequently either disregarded or not understood. The engineers should perhaps provide different instructions for the layman.

Supposing the wires have been removed, the problem consists in finding (1) in what order they should be placed and (2) to what position of the flywheel the ignition in the first cylinder corresponds.

The order of ignition can almost with certainty be told in advance for a four-cylinder motor. Nearly all those which have only two crankshaft bearings ignite in the order 1, 3, 4, 2, while those with three bearings usually ignite in the order 1, 2, 4, 3. But when the question is of a motor with separate cylinders, which is usually mounted with five bearings, or of a six-cylinder motor, the order of ignition needs to be verified. In that case the operator removes the spark plugs and the valve boxes and another person turns the crank slowly. He can then observe in what order one of the two sets of valves is raised. To tell the induction valves from the exhaust valves, it is useful to note that if there is a spark plug under one of them it is always under the induction valve. The ports to the manifolds, for that matter, also tell plainly which is which.

If there is nobody else to turn the crank, the best method is to place cork stoppers lightly in the spark plug holes and then to turn the crank. The corks will then pop out in due order.

Once the order ascertained it should be inscribed some place under the hood.

Now the wires may be attached, according to their length, to the magneto in their numerical order, 1, 2, 3, 4, and the other ends to the spark plugs of the cylinders in the order which has been found to be that of the ignition. In the case of a six-cylinder motor this order will ordinarily be 1 3, 5, 6, 4, 2.

Some magnetos have a visible index rendering it unnecessary to open the distributer to locate the connection to cylinder 1, and in that case it is advisable to first connect the ignition wire of cylinder 1 with its distributer-terminal. This facilitates the second part of the operation—which is the only one if the wires have remained connected in good order. It consists in finding the position of the piston in cylinder 1 corresponding to the moment of ignition. If the flywheel has been marked by the manufacturer for that purpose, the matter is easy. Otherwise the position must be found. If there is a petcock at the top of each cylinder, a wire may be introduced through it till it rests on the piston. When the crank is now turned, it is the moment for ignition when the wire is pushed out by the piston almost as far as it will come, provided both valves are then closed.

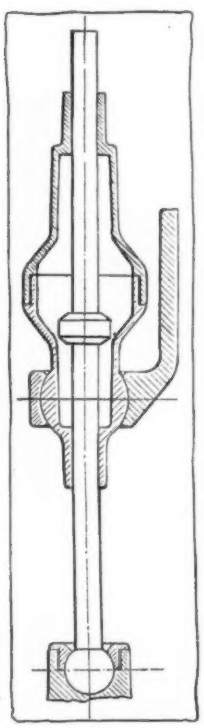
If, on the other hand, there is no petcock, recourse must be had to a little reasoning. The order of firing is known. Suppose, then, that cylinder 3 precedes cylinder 1 in firing, it is known that the exhaust begins in cylinder 3 at practically the same moment as the firing in cylinder 1. Consequently, when the exhaust valve of cylinder 3 is seen to open, cylinder 1 is in the desired position.

In the case of a valveless motor, the moment of highest compression in cylinder 1, which is a good-enough time for the spark for an emergency regulation, can be found by placing one's thumb over the spark plug hole. When the pressure reaches maximum, or a little before, the desired position is reached.—From *Omnia,* October 25.

How Racing Improved Automobiles

THE real inwardness of the racing influence upon construction is overlooked. The lessons were learned not in the race but before the race, not on the road but in the drawing office and the shops. In the present status science is blended with hard experience. It was in the consultations between the chief designer and the leading draughtsmen when drawings were discussed; at the test bench when adjustments were made or variations introduced; on the road trials when the designer accompanied the racing driver; at informal meetings here and there as the new machine made its way from the drawing board to the starting line; it was at such times that design was little by little formulated to an exact basis.

Some of the cleverest achievements have fructified without the incentive of racing: Maybach's spray carbureter, for instance, and Krebs' great improvement of it which pioneered the self-regulating system of carburation. But for the most part the science of automobile engineering has been built up in the works during the preparations for road racing and later for track racing.—From *Internal Combustion Engineering,* November 26.



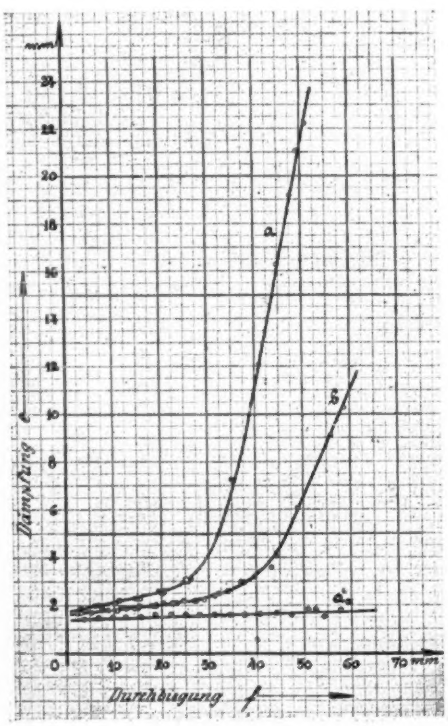


Fig. 7—Bobeth hydraulic spring damper. Fig. 8—Diagram of its action. Dämpfung=damping effect; Durchbiegung=deflection

Motor and Generator Arranged in Tandem

Latest Ward Leonard Combination Shows Novel Coupling of Units

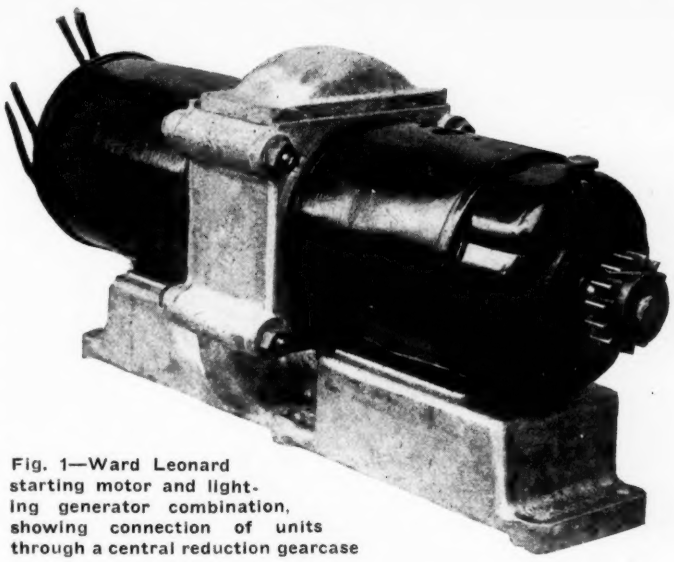


Fig. 1—Ward Leonard starting motor and lighting generator combination, showing connection of units through a central reduction gearcase

THE many designs of single unit and combined arrangements of separate units that are being put forward at present, point clearly to a demand for compactness in electric equipment. One of the latest of motor-generator tandems, Fig. 1, brought out by the Ward Leonard Co. shows an interesting deviation from the usual practice of arranging the two units one above the other. In this design the cylindrical motor and generator are mounted on the same base with their axes coinciding and are joined at the center by a reduction gear case. The base is hollow and contains the controller and starting switch.

Only one point of mechanical connection is provided, this being a pinion or chain sprocket keyed rigidly to the outer end of the lighting generator shaft. The latter receives its drive by means of this pinion and when the starting motor is in use the power is transmitted through the same external drive. In operating the motor, however, the inclosed reduction gear of 10 to 1 between the two units is brought into action, through an over-running clutch. As soon as the engine picks up and commences to turn the generator armature in the usual way the motor and reduction gear are automatically disconnected by means of the clutch and remain so until the starter is again required.

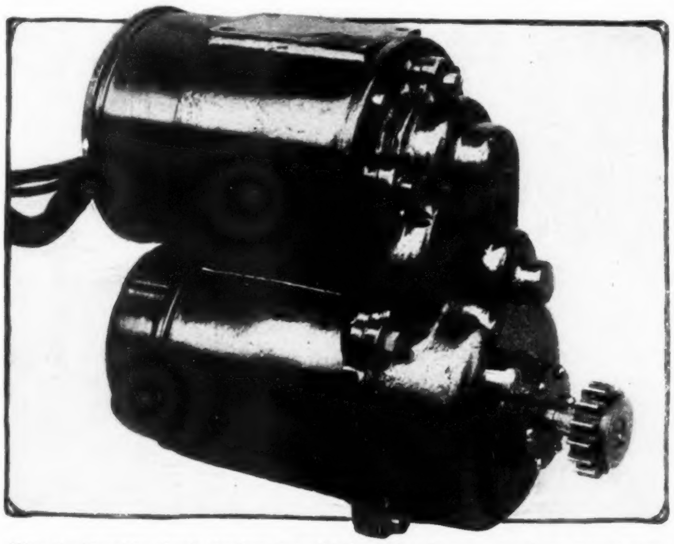


Fig. 2—Double-deck design in which motor is mounted on generator

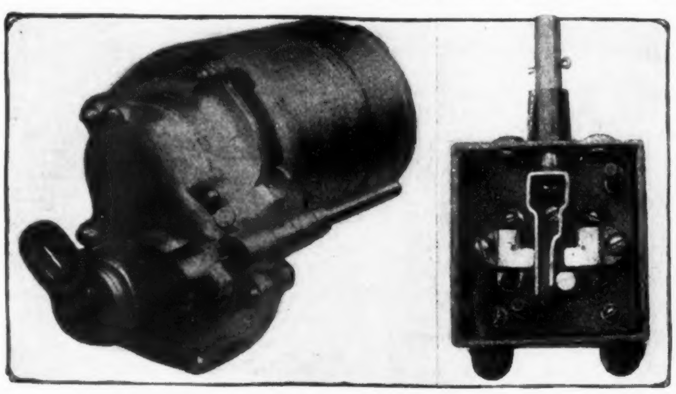


Fig. 3—Ward Leonard starting motor and switch for flywheel drive

The great advantages of this design are its small height and width, while the length of space required for installation is generally easily available. Its neat symmetrical appearance is also noteworthy.

Other types of electrical equipment by the same concern are shown in Figs. 2 and 3. The former is a double decker of the more conventional type in which a cast steel gear case extends across the ends of both units. The motor occupies the upper position and drives through a train of gears, Fig. 4, including an over running clutch R to the generator shaft. The reduction is double, an intermediate shaft S carrying a pinion which meshes with the outer member of the over-running clutch. Stuffing boxes B are provided in the gearcase so that the lower part can be filled with lubricating oil.

Fig. 3 shows a separate motor for application to the flywheel of the engine. A single step reduction gear is contained in the end cover and connection is made by sliding the outer pinion into mesh with the flywheel through the shifter rod at the side of the motor casing. In the complete equipment this is interconnected with the switch shown in the same illustration so that on first depressing the starting pedal the motor is switched across the mains through a resistance contained in the switch casing, then cut off momentarily while the pinion slides into engagement and finally switched in again without the resistance, applying the full starting torque to the flywheel.

In the case of the combined designs, since no meshing of gears takes place there is no necessity for this starting resistance, a simple one-point switch answering the purpose.

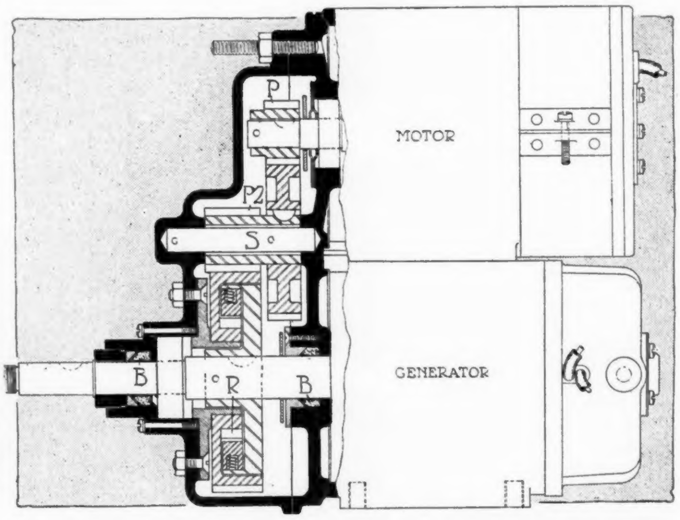


Fig. 4—Section showing reduction gear and clutch of double-decker

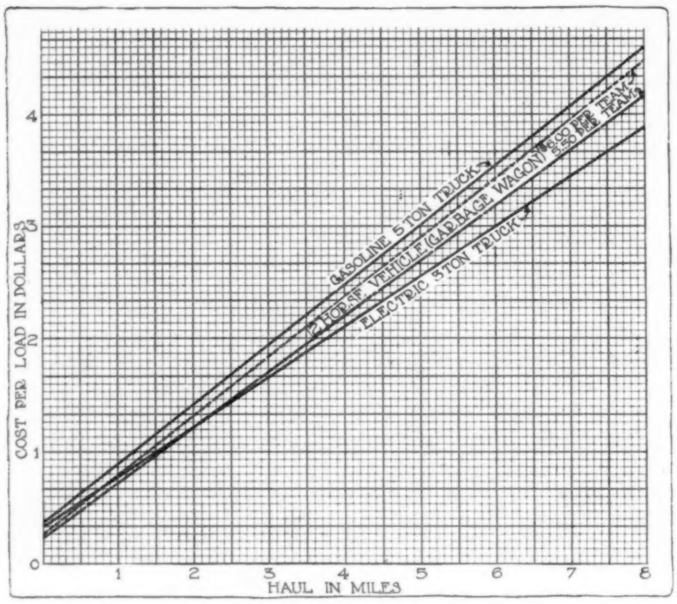


Fig. 1—Curves showing comparative economy of gasoline, electric and horse-drawn trucks in hauling garbage

Electric Trucks Would Save $15,775

Chicago Efficiency Bureau Estimates That Their Adoption Would Cut City Expenses That Amount Yearly

THE use of electric motor trucks in hauling Chicago's garbage and waste would save to the city $15,775 per year, while in hauling crushed stone and asphalt 25 per cent. of the present cost could be saved.

This is the estimate of the Efficiency Bureau, of Chicago, which recently recommended the adoption of motor trucks for city work in its annual report.

To fit the service to the motor truck it is planned to reorganize the present system of garbage collection, for, as stated, there are at present but 110 miles of improved alleys in Chicago out of a total of 2,028 miles. The new idea would be to increase the length of hauls by collecting the garbage locally on the bad alleys by carts carrying small units. These loads would be transferred at suitable points to motor vehicles, and, in turn, these motor wagons would at suitable sub-stations transfer the big unit loads to be hauled by big tractors in trains to the final disposal point. This would allow each type of vehicle to work to its best advantage.

Use of Motor Trucks and Tractors

Inquiries have been made as to the adaptability and economy of motor trucks in connection with the hauling of city refuse and crushed stone and other material for the repair of streets and alleys. Tests have been made on various kinds of motor trucks in different cities of the country with varying results, and inquiries have been directed to different municipalities and motor truck companies and several tests made in this city to determine the following:

1—The relative economy of hauling refuse and street repair materials by motor trucks and by teams.

2—The kind of motor truck best adapted for this purpose.

3—The practicability and economy of discarding present equipment and the purchase of motor trucks.

The matter of the relative economy in the use of motor-driven and horse-drawn vehicles for different lengths of haul has been treated by R. T. Dana, member American Society of Civil Engineers, who shows the variation in cost per ton for different lengths of haul from .25 mile to 10 miles and the saving that would result in the use of motor-drawn vehicles. Following are his summary figures:

Loaded haul, miles	Cost per ton: Horse-drawn	Cost per ton: Motor-drawn	Cost per ton-mile: Horse-drawn	Cost per ton-mile: Motor-drawn	Per cent. saving by motor-drawn
¼	$0.16	$0.19	$0.640	$0.760	—18.8
½	.22	.24	.440	.480	—9.1
1	.32	.32	.320	.320	0.0
2	.50	.48	.250	.240	4.0
3	.70	.62	.233	.207	11.2
4	.90	.79	.225	.198	12.0
5	1.09	.96	.219	.192	12.3
6	1.29	1.12	.215	.187	13.0
7	1.48	1.28	.211	.183	13.2
8	1.68	1.44	.210	.180	14.3
9	1.88	1.60	.209	.178	14.7
10	2.07	1.77	.207	.177	14.7

Similar investigations have been made at the Massachusetts Institute of Technology and the following summary shows the relative cost of operating the horse-drawn, gasoline and electric commercial vehicles, based upon the different sizes of vehicles:

Size of Vehicle, Tons	Number of miles traveled for expenditure of $1: Horse-drawn	Gasoline-driven	Electric-driven
½	3.9	3.6	4.3
2	2.9	2.6	3.1
3½	2.2	2.3	2.7
5	1.7	1.9	2.2

Further analysis has been made on the actual economies that may be expected by the use of this equipment under conditions existing in this city and the relative adaptability of the gasoline and electric motor trucks for the work that may be required in this city has been analyzed. The following table gives a detailed comparison of the advantages of each:

Gasoline Truck

(a) Greater average speed possible.
(b) Can be run continuously night and day.
(c) Are essential outside of the radius of operation of the electric truck.
(d) Can do more work in a given time if speed restrictions do not interfere.
(e) To properly care for batteries requires the services of a man more difficult to obtain than in the case of gasoline motors.
(f) Less balking on unimproved streets.

Electric Truck

(a) More efficient where the short haul with many stops are encountered.
(b) More efficient within its limits of operation, which approaches from 50 to 60 miles per 8-hour day.
(c) More economical motive power.
(d) Less average per cent. maintenance and repair costs.
(e) Less per cent. depreciation.
(f) Requires less skill to drive.
(g) Affected less in winter by temperature.

In making an estimate of the cost of hauling, the following assumptions as to cost of operation, interest and depreciation on investment have been taken into account:

Interest on investment, 4 Per Cent.
Insurance and fire liability (gasoline), 3 per cent. $70 per annum
(electric), 3 per cent. 63 per annum
Garage .... 25 per month
Compensation of driver (3-ton truck).......... 80 per month
Depreciation gasoline truck, estimated life 75,000 miles on truck value minus tires.
Depreciation on electric truck, estimated life 100,000 miles on truck value minus tires.
Tires—Depreciation based on guarantee, 8,000 miles.
Contingencies—Covering interest on general operating stores, repair materials, general superintendence, etc., 2 per cent. of the first cost.
Antiquation—Estimated as a fixed charge, it being a factor which decreases the value of equipment due to improved methods in the science of construction, 5 per cent.
License—State license paid by the city, $4.00 per year for 3-ton truck.
Operating values—Taken from actual results obtained in the operation of 14 standard gasoline trucks, 100 electric trucks, and data obtained from the Massachusetts Institute of Technology, Experimental Work:

Size of truck	No. of miles per gal. for gasoline cars	No. of kw. hours per mile for electrics
2-ton	5.00	.741
3-ton	3.92	.903
4-ton	3.20	1.064
5-ton	2.70	1.225

Assuming that a 3-ton truck is loaded to full capacity, an estimate based upon the above assumptions was made of the cost per mile of hauling refuse as compared with the present cost

of hauling by two horse garbage wagons which are now contracted by the city at the rate of $5.50 per day. Similar estimates have been made on the basis of hiring garbage teams at $6 per day. The results of these analyses are shown in Fig. 1, which has curves of the relative economy of the three types of vehicles of 3-ton capacity for different lengths of haul.

Tests have been made during the past year on the use of motor trucks for hauling crushed stone and material for the street repair work. It was found that the conditions entering into the hauling by motor trucks for such work are generally favorable to the use of motor trucks.

In estimating the probable economy of the transportation of pavement material by the use of motor trucks, the following assumptions have been made, based upon the experiences and requirements in Chicago.

1—That 5-ton trucks will be used.
2—That these trucks be equipped with dump bodies.
3—That the time required for loading and unloading will be 5 minutes.
4—That each truck will be in actual use 7 hours per day, this being liberal for necessary delays in traveling, loading, etc.
5—That an average speed of 7 miles per hour can be maintained by electric motors; 8.5 miles by gasoline trucks.
6—That the other charges entering into the cost of operation are the same as the assumptions for 3-ton trucks estimated for garbage service.

The following assumptions were considered in estimating the economy of the use of horse-drawn vehicles for hauling the same materials:

1—Capacity of stone wagon...............7,500 pounds
Capacity of asphalt wagon ....8,900 pounds
2—Time required for loading or unloading. 5 minutes
3—Average speed of wagon...............2.7 miles per hour
4—Cost per day—wagon, team and driver. $6.00

Analysis of the estimates has been made and curves showing miles per day, cost per ton load and cost per ton delivered in street work based on the above assumptions are shown in Fig. 2. These curves show that the use of motor trucks is more economical than horse-drawn vehicles when same are used for a period of at least 300 days per year in the transportation of crushed stone, asphalt and other street repair materials. If the period in which the transportation equipment is used is less than 180 days each year, which is the minimum period in which street repair work will be made during any year, the use of horse-drawn asphalt wagons is more economical and the use of horse-drawn wagons for hauling crushed stone is less economical than any type of motor truck. The curves further show that in order that the cost in using electric trucks instead of asphalt wagons be equalized, the electric truck must operate at least 230 days each year and the gasoline truck must operate at least 260 days each year. Under favorable conditions, the motor trucks would be more economical than horse-drawn vehicles for the transportation of crushed stone and asphalt and the use of electric trucks will probably show a saving of approximately 25 per cent.

The study of the economy and adaptability of the use of motor trucks for hauling garbage and other city refuse as shown above and in the curves in Fig. 1, has led to the following conclusions:

1—That at the present prevailing cost of team hire, the saving in the use of electric motor trucks for hauling garbage in such wards as have a considerable haul, would amount to 5.1 per cent. of the total cost of removing such garbage by teams.
2—That if the cost of teams were increased to $6 per day the total estimated saving by using motor trucks for hauling would be about $15,775 per year or 12.3 per cent. of the total estimated cost of teams at $6 per day.
3—That, inasmuch as these estimates are computed on the 8-hour day basis, and that the present working period of garbage teams rarely amounts to 8 hours per day, and often the working period is as low as 6 hours, that the saving which could be expected would exceed the percentage given.
4—That either the gasoline or electric power truck can handle the hauling of garbage with comparative ease and with approximately equal satisfaction.
5—That the more economical power truck has been found to be electric. This is governed in a measure by the low rate of cost of electrical energy from the Sanitary District to the city for night power, and by the fact that the collected data on the electric truck have shown lower per cent. rates for depreciation, maintenance, repair and insurance than for the gasoline truck.
6—That the haul below which an electric truck, carrying 3 tons, would not be economical when measured against a $5.50 per day team is found to be about 1.8 miles, and when measured against a $6 per day team is 0.8 mile.
7—That the 3-ton gasoline truck at present cost price would not haul as economically, when traveling in the city at the economical rate of speed, as would the horse-drawn vehicle at either $5.50 or $6 per day, and traveling at the rate of speed found by experiment on garbage wagons.

In all discussions regarding motor-driven vehicles for the collection of garbage and refuse it must be borne in mind that there are but 110 miles of improved alleys in the city out of a total of 2,028, and that until the percentage of paved alleys is materially increased the adoption of motor vehicles for such work seems impracticable.

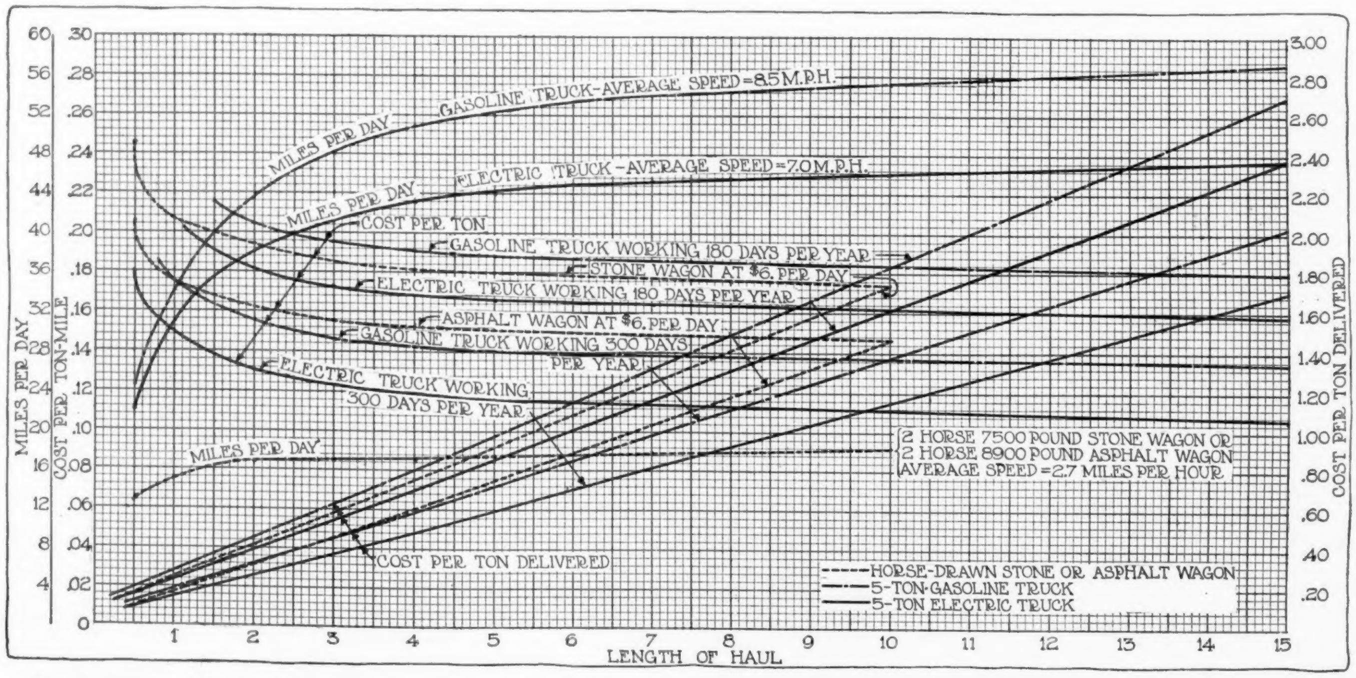
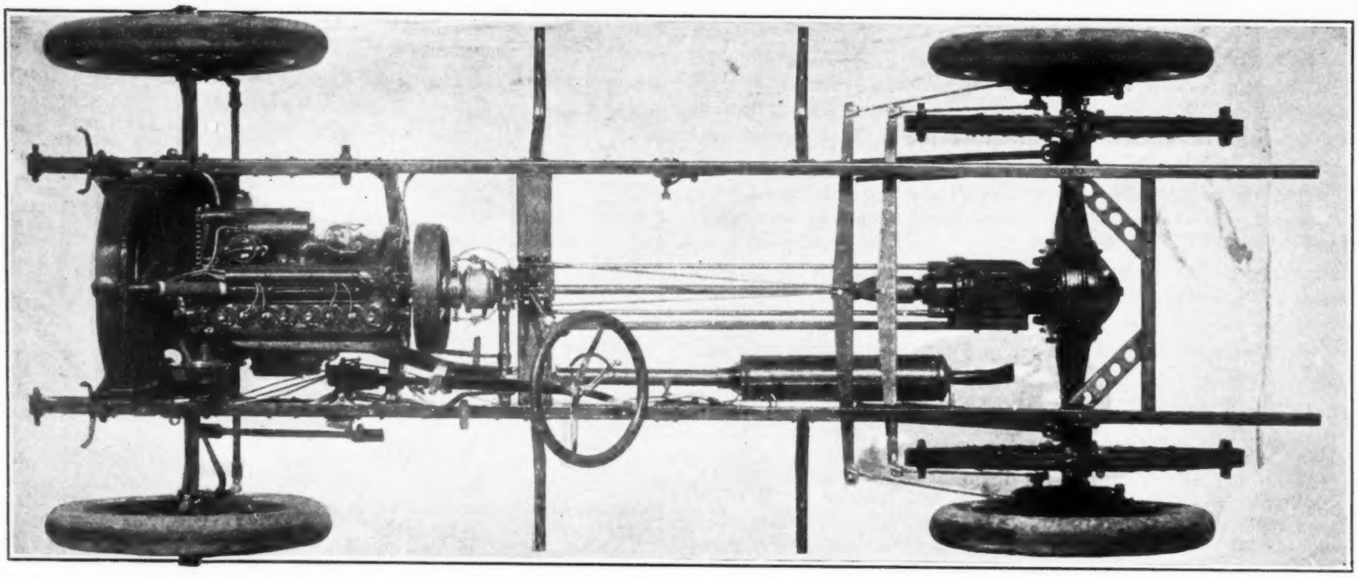
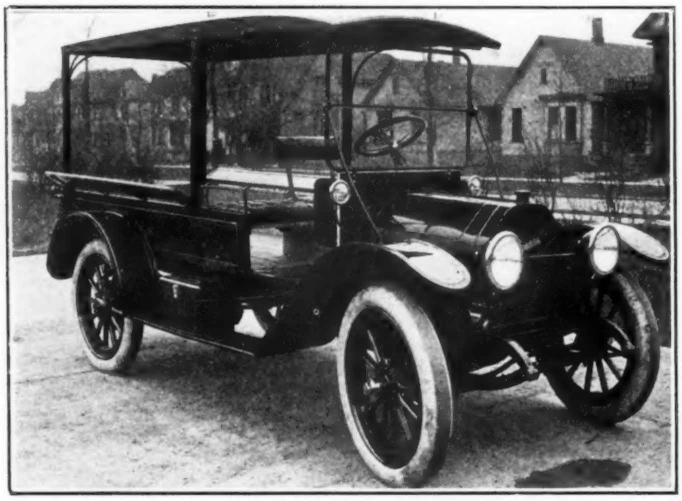


Fig. 2—Curves showing miles per day, cost per ton load and cost per ton delivered in work in paving streets of various vehicles





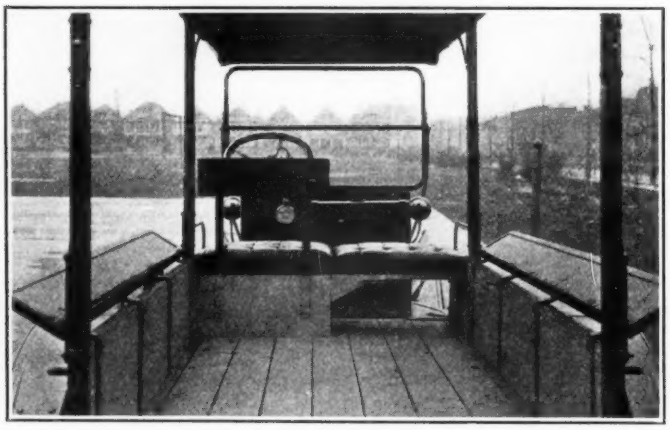


Fig. 1—Plan view of new Studebaker delivery chassis
Fig. 2—Stake body with canopy top and side curtains
Fig. 3—Fuel tank on dash. Note instrument board
Fig. 4—Loading space. Note folding seat arrangement

A Truck with a Starter

New Studebaker Has Wagner System—Also Dash Fuel Tank

A LIGHT delivery car, which seems to have been designed with more than usual perception for the details of the problem, is offered by the Studebaker Corp. under a capacity rating of 1,500 pounds. Although several units are the same as used in this company's pleasure cars, the new commercial vehicle is by no means a pleasure car chassis with a truck body mounted thereon. For instance, the frame, which may be considered the backbone of the car, is a special design without in-sweeps or kick-ups. Channel sections 4 inches deep take care of the extreme bending moments that arise in delivery work due to an unusual concentration of the load.

The four-cylinder motor has a stroke-bore ratio of 1.43, the stroke being 5 inches and the bore 3.5 inches, and is the same as used in the four-cylinder passenger model.

In the delivery car a governor has been added to the standard motor. This adjunct will insure the owner against the evils of high speeds. The company recommends a governor adjustment that will keep the maximum speed down to 20 miles an hour where the conditions are good. In cases where the roads are poor a lower limit is, of course, advised.

Electric System Is Studebaker-Wagner

The use of a governor in the commercial field is not at all unusual, but the incorporation of an electric starter in this type of car is decidedly a novelty. The electrical system is the Studebaker-Wagner design and provides for the lighting and ignition as well as the starting.

From the motor the power is delivered to the rear axle unit through a cone clutch and a shaft provided with two universal joints. The clutch trunnion is provided with ample lubrication from a very accessible grease cup mounted on the H-plate of the center control.

Following the well-known Studebaker practice, the transmission is a unit with the rear axle. The reduction at the bevel gears is 4.6 to 1. With the 34 by 4-inch tires this means that, neglecting slippage, the motor would turn over approximately

910 revolutions per minute when the car was traveling 20 miles per hour on high gear. Timken roller bearings are used throughout the floating rear axle and also in the transmission. There are two of these bearings in each wheel, one on each side of the differential, one back of the driving pinion and two at the front of the transmission. A noticeable characteristic of the axle is the short hub and the secure fastening of the cap through which the power is transmitted to the wheels. The torque reaction is taken up by a suitable member attached to the transmission housing and spring mounted at the central frame cross bar.

Fuel Tank in Dash

Probably the most striking feature about the complete car is the large fuel tank fastened to the dash. Its accessible location on the right side, together with the large size of the filler cap, renders filling easy. Another advantage of the new location is the same high head of fuel and short piping to the carbureter that have become quite general in passenger cars by the use of cowl tanks. The tank does not block the way to the driver's seat on the left nor cramp the legs of a helper, for it projects no farther than the control pedals. The left side of the dash serves as an instrument board, Fig. 3, clearly showing the rather unusual equipment for a truck of a speedometer, oil sight, ammeter and coil switch. The starter button is in the floor toward the seat. Near the clutch and brake pedals is an accelerator pedal and a muffler cut-out. The switches for the full set of electric lights are in the heel board.

Two body types are offered, a full panel job made up in metal and an express body with top and side curtains as shown in Fig. 2. The car sells for $1,150 complete. The chassis alone is $1,050.

Special First Aid Truck for Miners Made by White Company

FOR rescuing, reviving and treating entombed and injured miners and thus reducing the loss of life and lessening the injuries resulting from the periodic disasters in coal mines, etc., the Bureau of Mines of the Department of the Interior has evolved a new plan of relief work involving the extensive use of motor trucks of a special design and equipped with all the pharaphernalia known in the science of relief work.

The first vehicle of the new type, built according to government specifications, was constructed by the White Co., Cleveland, O., and delivered to the Bureau of Mines in Pittsburg, Pa. It is a veritable hospital, carrying every piece of portable equipment that is useful in rescuing miners, quenching flames and administering first aid.

The body, which resembles a closed express type, has seating capacity for twelve men; two on the front seat and ten on the two longitudinal seats that are entered from the rear. Every inch of room not taken up by the seats houses equipment. There is a large locker under the driver's seat, and two lockers, one over the other, directly back of it, extend to the roof. Four lockers are located under the rear seats, two on each side, these compartments having been made as high as possible yet leaving sufficient headroom for the occupants of the seats above them.

Under the driver's seat ten Draeger reviving outfits are carried, and immediately back of it and extending the full height of the body there is a series of compartments opening on the outside of the truck. These house a tent, a life-line reel, 22 feet of hose, three miner's picks, three shovels, one 4-pound sledge and two axes.

Telephone System Carried

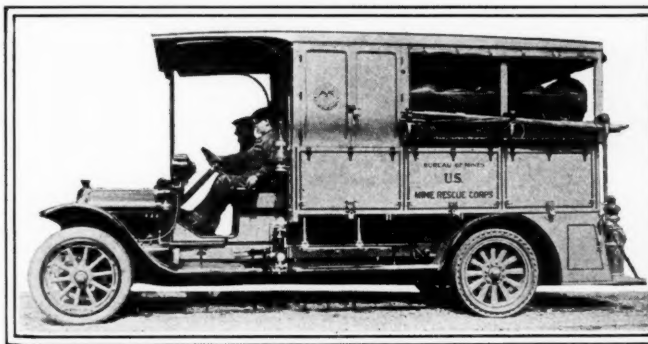
In back of these compartments are the two rear seats, arranged lengthwise, with folding lazy-backs and protected by a brass railing. Beneath each of these seats are two compartments in which are contained a telephone system, part of which is carried into the mine, and an assortment of compasses, braces, bits, chisels, hacksaws, and snatch blocks.

Along the backs of these seats, on the outside of the body, on specially designed hooks are suspended stretchers, fire extinguishers, axes and lanterns.

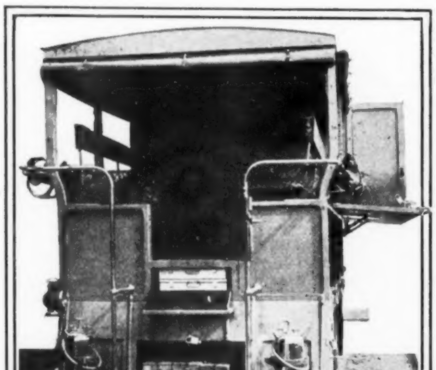
Six oxygen tanks are carried beneath the body on a subframe, the tanks lying cross-wise of the truck and so located that they may be pulled out quickly when necessary.

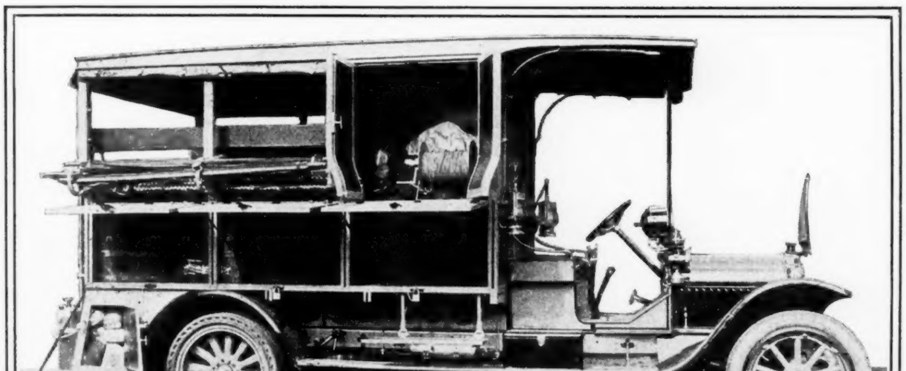
The running boards carry a motor-driven oxygen pump and two large boxes for mine lanterns.

Beneath the rear steps are drawers which hold saws, hose couplings, reducers, spanners and 200 feet of .5-inch rope. The truck is equipped with an 8-inch swivel headlight, mounted on the dash, and is fitted with pneumatic tires in front and solid cushion tires with dual tread in the rear.

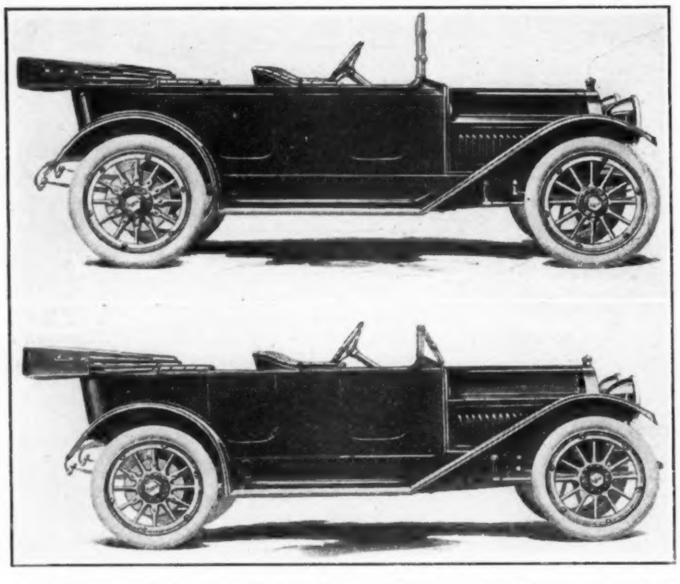


Ready for work. Note oxygen pump on running board



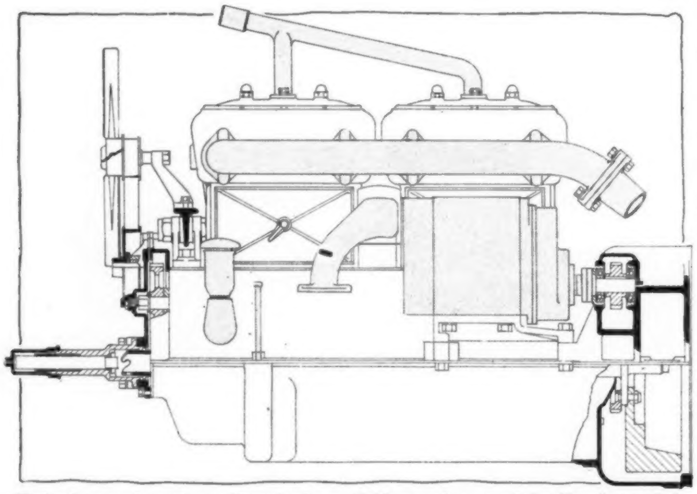


Rear view, showing lockers. Side view of special hospital truck for use in mine accidents. Note compact loading

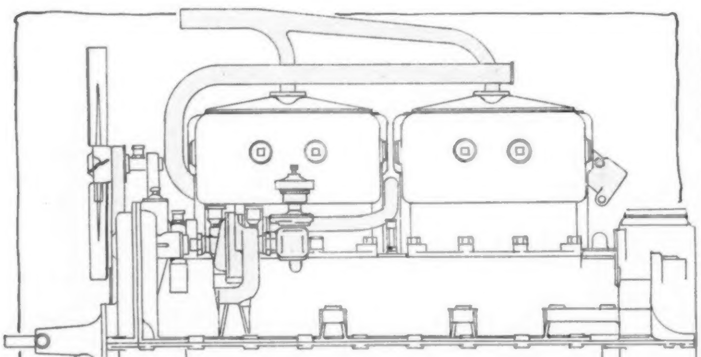


Upper—Imperial six-44 touring car for 1914. This car is fitted with a six-cylinder Continental motor having a bore of 3.75 inches and a stroke of 5.25. Last year this engine was 4.75 by 5.25. The motor used this year is rated at 34 horsepower, according to the S. A. E. formula, but its actual showing at 1,500 revolutions a minute is 48 horsepower, according to the maker. This car is fitted with the North East electric lighting and cranking system and sells for $2,000

Lower—Model four-34 Imperial touring car. This model uses a Falls motor with a bore of 4.5 and a stroke of 5 inches, .25-Incn shorter than in the 1913 model. The wheelbase is 118 inches and the body is a five-passenger type of flush-sided appearance and latest design. This car sells for $1,650



Exterior and part sectional view of the motor used in the Imperial model 34



Left side of six-cylinder motor used in model 44 Imperial

Imperials in Four Chassis

Two Fours and Two Sixes Offered for 1914—Left Drive on All Models

IMPERIALS are offered in four chassis models for 1914 as for this year, although even greater refinement of details and some chassis changes are found on investigation. For 1913, there were three four-cylinder Imperial chassis, but in the new series, one of the fours has given way to a six-cylinder machine, so that now we are offered two fours and two sixes. The model numbers are exactly the same as they were, namely, models 54, 44, 34, 33 and 32. The latter two refer to roadster and touring body types fitted to the same chassis. It is model 44 which, though formerly a four, is now a six-cylinder car of medium size.

Each of the four chassis is equipped with a different power plant than it carried heretofore. The sixes have Continentals; model 34 is provided with a Falls and models 32 and 33 have a Clark motor. And whereas all cars except the larger six, model 54, were driven from the right in 1913, the new editions are left-driven uniformly throughout the list. Center control is continued. Splitdorf dual ignition takes the place of that of another maker, while North East electric lighting and cranking is fitted to all models.

Prices conform pretty closely to those of 1913. Model 54 is still a $2,500 car; model 44, now a six-cylinder machine, is priced at $2,000 as compared with its figure of $1,875 last year as a four; model 34 is still offered at $1,650; and models 32 and 33, for which $1,285 was previously asked, are now set at $1,500 but their equipment is much greater, including chiefly electric lighting and cranking which was not fitted before.

Model 54 Has New Motor

Though its chassis has come in for very little alteration mechanically, this model 54, the largest and most expensive in the Imperial line, has a new Continental engine of 4 1-8 inch bore and 5 1-4 inch stroke, giving a normal horsepower rating of 45, although the motor is said to develop 60 horsepower at 1,500 revolutions a minute. The cylinders are cast in sets of three with valves all on the right and inclosed completely. The model 54 of 1913, carried a 4 by 5 1-2-inch block-cast engine.

The motor is of the unit power plant construction with the gearbox bolting to the rear of that part of the crankcase which houses the flywheel and multiple disk clutch. The three-point method of suspension is therefore taken advantage of, there being two integral crankcase arms at the rear while the front end is hung from an arched cross member at its center.

The right side being the valve side, the manifolds are both here, the carbureter and magneto also occupying positions on this side. This leaves the left side free for the shaft which drives the centrifugal water pump and the combined electric motor and generator with its small gearbox. Each cylinder has an individual opening into the exhaust header, while there is a common opening into the intake manifold from each block of three cylinders.

The crankcase is conventionally split longitudinally, the lower half carrying the reservoir for the lubricating oil, while the upper half forms a mounting for the three crankshaft bearings. Housed completely at the front are the helical timing gears for driving camshaft and magneto shaft, and the silent chain drive for the pump and motor-generator shaft.

The moving parts are very finely balanced and made as light in weight as possible to be consistent with strength, these features tending to reduce vibration to a minimum. The pistons which are cast from a harder grade of iron than the cylinders carry four rings 1-4-inch wide. The nickel-chrome steel piston pins are fastened to the piston bosses, the connecting-rod upper end bearing moving on them. The connecting-rods are drop forged from .35 to .45 carbon steel. The camshaft is also a carbon steel drop forging and may be readily withdrawn by the removal of the gearcase cover. The crankshaft is of liberal proportions and made of the same alloy steel as the connecting-rods. Bearings are all of nickel babbitt.

A force-feed constant level system of lubrication is used, and is effected by means of a plunger pump driven by an eccentric from the camshaft. The oil is pumped through copper tubes direct to the timing gears and over the rear main bearings. It then drains back into the crankcase, thus maintaining a proper level for the splash lubrication of the pistons, connecting-rods and crankshaft bearings. Provision is made for draining the oil.

The electric-motor generator which is carried on brackets cast on the crankcase is connected with the crankshaft through the silent chain already mentioned. This chain runs over sprockets on the ends of the pump shaft and crankshaft. The electric unit, first acting as an electric motor cranks the engine by driving through its train of reduction gears housed on a bracket just forward of it, through the pump shaft and then the chain. As soon as the engine is under its own power, it does the driving, turning the pump shaft at twice the engine speed.

The Willard storage battery which is used with this electrical equipment is concealed in the new cars while last year it was mounted on the running board.

The clutch has thirteen steel disks which are faced with Raybestos. It is operated by triple clutch springs and the rocker operating shaft is carried through the bell housing for connection to the pedals. The gearset which is compactly enclosed just behind the clutch gives three forward speeds. Its mainshaft, countershaft and gears are made of 3.5 per cent. nickel steel and all shafts operate on annular ball-bearings. The control has been changed from the H-gate type to the ball and socket construction which is a growing tendency among makers because of the simplicity of operation. It also takes up less of the very valuable floor space in the front compartment of the car.

The power is delivered to the rear axle by a 1 3-8-inch chrome-nickel steel drive shaft which is uninclosed. This construction permits of the use of two universal joints—one at either end of the shaft. A well-designed torsion arm parallels the drive member back to the rear axle in conventional manner, while radius rods on either side assists in maintaining the alignment and in the drive. The rear axle is floating and has a pressed steel housing. It has a differential of special Imperial design with stub tooth gears of four pitch. This is also true of the ring gear and the pinion. The axle ratio is 3 1-2 to 1.

The brakes are of the double internal type acting in 18-inch drums which have a width of 2 inches. The brake shoes are Raybestos lined. The rear springs are three-quarter elliptics, underslung from the axle and 53 inches in length. The fronts are 40 inches long. At the rear is the 25-gallon gasoline tank which feeds to the carbureter by pressure.

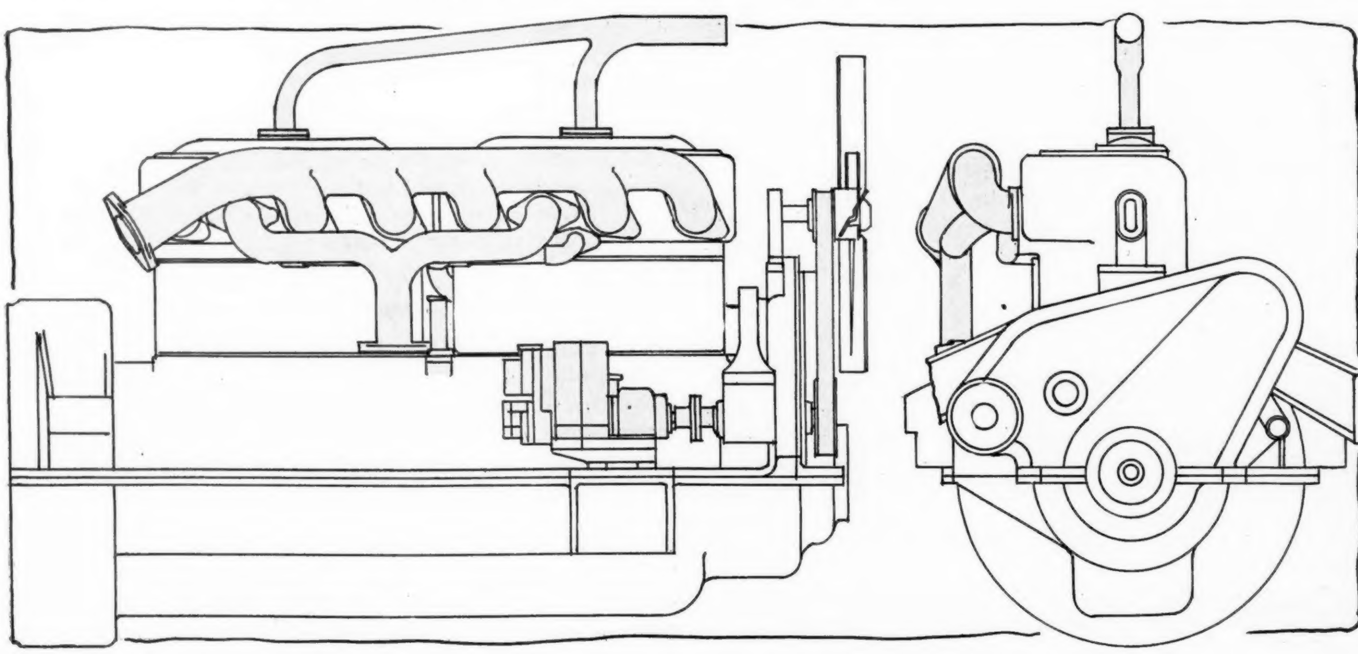
This model 54 has a wheelbase of 137 inches, is standard in tread, is mounted on 12-spoke artillery type wheels which carry 36 by 4 1-2-inch tires on demountable rims and is complete with everything required of the car of today.

Seven-Passenger Body Is Standard

The standard body is a seven-passenger type which conforms closely to latest practice. Running boards are entirely free of encumbrances, door handles and hinges are concealed and lines are attractive and graceful. The windshield is of somewhat new design, presenting a racier appearance on account of its being

PRINCIPAL DIMENSIONS OF THE IMPERIAL POWER PLANTS IN INCHES

	Model 54	Model 44	Model 34	Model 32-33
Length of piston	5 5-8	6	5 7-8	....
Valve diameter	2	1 11-16	2 1-8	1 15-16
Valve lift	....	....	....	5-16
Crankshaft bearing diameter, front	2	2	2	2
Crankshaft bearing diameter, center	2	2	2	2
Crankshaft bearing diameter, rear	2 1-4	2	2	2
Crankshaft bearing length, front	2 13-16	3 1-4	3 1-4	3
Crankshaft bearing length, center	3 1-2	3	3 1-4	3
Crankshaft bearing length, rear	3 13-16	3 7-8	4 1-4	4 1-8
Camshaft bearing diameter, front	2 1-4	2 1-4	1 1-8	....
Camshaft bearing diameter, center	2 1-4	2 1-4	1 1-8	....
Camshaft bearing diameter, rear	1 7-8	1 1-8	1 1-8	....
Camshaft bearing length, front	2 5-16	2 5-8	3 1-2	....
Camshaft bearing length, center	1 5-8	1 7-8	3	....
Camshaft bearing length, rear	1 3-8	2 1-8	2 1-2	....
Connecting-rod bearing length	2 1-4	2 1-4	3 1-4	2 1-2
Connecting-rod bearing diameter	2	1 7-8	2	2
Connecting-rod length	11	10 3-8	11	11
Number rings per piston	4	3	4	4
Width piston rings	1-4	3-16	1-4	3-16
Fiston pin bearing diameter	1 7-32	1 7-32	1 3-8	1
Piston pin bearing length	1 7-8	1 7-8	....	2
Flywheel outside diameter	17 1-4	15	....	16 1-4
Flywheel face width	5	4 3-8	....	4 7-8



Right side and front elevation of six-cylinder motor used in Imperial model 54 for 1914

lower. This may be said to hold true of the body types used on all the 1914 models for all are designed with a view to attractive appearance as well as to the highest degree of comfort.

In general appearance, the new model 44 Imperial is the same as last year, although it has been lengthened somewhat to accommodate the six-cylinder power plant which replaces the four heretofore used. The wheelbase is now 126 inches as compared with 122 before. The 4 3-4 by 5 1-4-inch engine has given way to a 3 3-4 by 5 1-4-inch six-cylinder which is of the same make as that used in the model 54—a Continental.

Like the big six engine, this has its cylinders cast in threes, is an L-head with valves on the right and throughout has much the same design characteristics. The right side is the manifold side and also carries the magneto. Suspension is the same three-point type with two integral crankcase supports at the rear and one center front support from an arched cross-member which passes over the crankcase between timing gear housing and front cylinder casting.

This motor is rated at 34-horsepower by the S. A. E. comparative formula but its actual showing at 1,500 revolutions a minute is 48 horsepower according to the maker. Such high power is partly due to the great preponderance of the stroke length over the cylinder diameter, but the fine balance of all of the working parts undoubtedly has a great deal to do with it. The crankshaft is on three bearings; the camshaft has an equal number.

Lubrication, cooling and electric equipment match up uniformly with these features of the large six and a detail description of them here would be a repetition of what has already been said. The clutch and gearset, too, are of the same design as found in the model 54. They are housed in unit with the power plant.

Drives Through Inclosed Propeller Shaft

But unlike the big six, the drive of the model 44 is through a propeller shaft inclosed within a torsion tube, the front end of which is provided with a yoke which hinges to the frame cross member. Diagonal radius rods run to the ends of the rear axle and the universal joint is at the front end of the shaft in accord with standard practice.

The rear axle is floating and of the same design as that fitted to the larger car. Brakes are the same in construction and size, as are the wheels and tires, which are fitted with demountable rims. The rear three-quarter elliptic springs measure 50 by 2 inches, and the fronts are 38 by 2 inches, which dimensions make for ample spring action and ease of riding. But this car does not carry its fuel tank at the rear. It is under the front seat, feeds by gravity and contains 17 gallons.

Model 34 Has Shorter Stroke

The new motor of the Imperial 34 is of the same bore as the old one—4 1-2 inches, but the stroke is now 5 inches, or 1-4 inch shorter. It is a Falls make and has its cylinders in pairs of the L-head type, valves being placed on the left and inclosed. A unit power plant construction is also to be found with the assembly suspended at three points. Manifolding is on the valve side, and the general design has been well carried out with an aim for simplicity and accessibility.

The moving parts are conventional in design and carefully made. Both crankshaft and camshaft have three bearings. Helical timing gears are well inclosed at the front end. All of the bearings are of die cast nickel babbitt of very large proportions. The lubrication system is of the constant level splash type with force feed to the points of supply. The bottom of the crankcase forms the oil reservoir. The cooling is by centrifugal pump which is 6 1-4 inches in diameter. Pistons are each provided with four rings, which efficiently prevent compression leak.

The magneto dual ignition system is used with dry cells for starting. The same type of electric lighting and cranking is standard on this as on the other models, the only difference being in the method of drive. Instead of driving through chain connection at the front as we have seen, this car's equipment provides for drive at the rear of the motor through chain. The motor-generator is mounted on the left rear side of the upper half of the crankcase and a sprocket on its shaft lines with another on the crankshaft just inside of the flywheel flange. The whole driving mechanism is completely housed in. The electrical unit is either driven or drives the engine as the case may be.

As in the other models already considered, the multiple-disk clutch and three-speed gearset are used with the same design and construction. Back of these parts, too, the drive goes to the rear through an inclosed propeller shaft, the rear assembly being uniformly similar to the others. The floating rear axle has a malleable housing, while the gears are all 4-pitch, stub-toothed. Sixteen-inch double internal brakes, 48 by 2-inch three-quarter elliptic rear springs, 34 by 4-inch tires on demountable rims are among the other features.

The wheelbase is still 118 inches, and the body a five-passenger type of flush-sided appearance and latest design.

Models 32 and 33 Are Conventional

The former 4 1-8 by 5 1-2-inch engine of the 32-33 Imperial has been replaced by a 4 1-4 by 5 1-4 Clark motor which, like its predecessor, is a block-cast type. It is a three-point suspended machine with the clutch and gearset in unit with it. Conventional design features hold throughout. The valve mechanism is enclosed, the crankshaft has three bearings, the camshaft has three, the water cooling is by a centrifugal pump circulation. The oil is distributed by a pump and conveyed to the connecting-rod wells by a copper tube. The lubrication of the bearings is by a constant level splash system.

The magneto dual ignition is also separate from the North East cranking and lighting apparatus in this car as in the other models. The electrical unit combining these two functions is mounted so as to drive at the front end of the crankshaft through sprockets and chain. The ratio is 2 to 1 between starter shaft and crankshaft, this being accomplished by providing the motor sprocket with seventeen teeth and the crankshaft one with thirty-four teeth. The chain centers are about 10 inches apart. The unit is mounted back of the water pump on the same shaft and to the right of the cylinder block.

The clutch is a multiple disk with semi-steel plates, and the gearset gives the usual three speeds forward, its shafts being carried on annular ball bearings. The driveshaft is inclosed in a torsion tube which has a yoked front end and is diagonally braced by radius rods. The rear axle is floating and has a malleable housing. As in all other models except the big six, the 32-33 has its gasoline tank up forward and under the drive seat in the touring model, but back of it in the roadster.

The wheelbase of this model remains at 114 inches; tires are still 34 by 4 front and rear and are on demountable rims.

Roadster and five-passenger touring car, models 33 and 32 respectively, are very well laid out and give the appearance of much power and speed as well as roominess. They are undoubtedly big value for the money.

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Mercer Uses Willard Storage Battery

New York City, Dec. 12—In the description of the Mercer car published in The Automobile for December 4, a sub-head stated that Rushman lighting and cranking is used. This was a typographical error and should have been Rushmore. In the same description it was stated that Witherbee storage batteries are used. This should have been Willard.

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Correction—In The Automobile for November 13, under the heading, Interested in Cyclecar Design, the following sentence occurred: "In turning a corner, the drive is through the outer wheel alone, the inner axle shaft overrunning its wheel." This should have read: In turning a corner, the drive is through the inner wheel alone, the outer axle shaft overrunning its wheel.

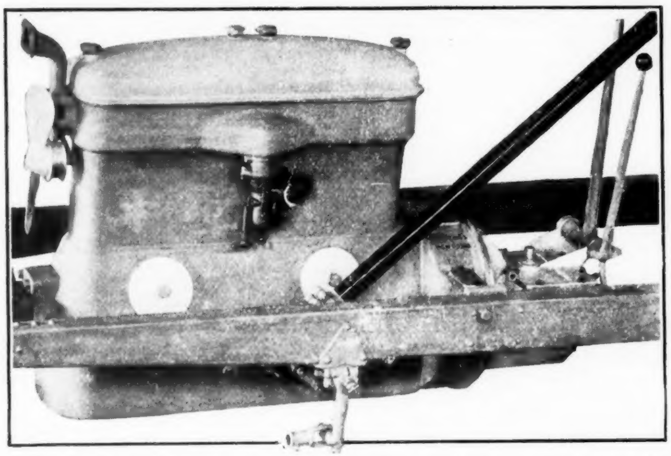


Fig. 3—Intake side of Weideley motor, showing absence of intake manifold, mounting of gearbox as a unit with the motor, cover plate for valve mechanisms and fan mounting

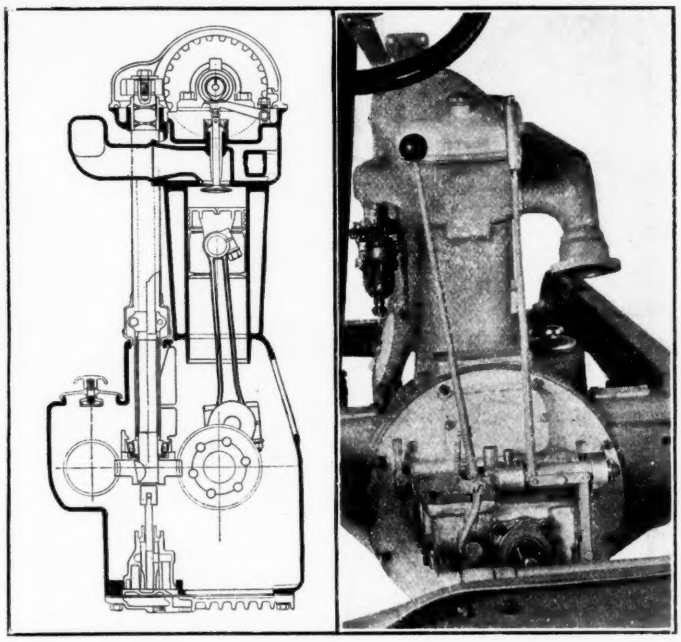


Fig. 1—End section and rear view of Weideley motor with cylinders 3⅝ by 5½ inches. Note crosshead piston in which the top part taking the pressure of the explosion is separate from the skirt portion which serves as a guide. Note overhead camshaft, together with complete covering for same. At the right are shown the cylinders and crankcase in one casting.

Premier Adopts New Valve-in-Head Motor

Six Cylinders and Entire Crankcase in One Casting—New Two-Part Pistons—Simplicity, Fuel Economy and Great Flexibility in Design

AFTER hearing for several months about the new valve-in-the-head motor which the Premier Motor Mfg. Co., Indianapolis, Ind., has been testing over the Hoosier roads as well as on long country trips the expectant automobilist has had his anxiety satisfied by the announcement of this new motor, which is christened the Weideley, after its designer, George A. Weideley. This new motor, in addition to being a valve-in-the-head type with overhead camshaft, incorporates not a few other interesting details, all of which point towards the simplication of parts and the elimination of unnecessary fittings, etc. The new model is an addition to the Premier line, the six-60 and six-40 being continued.

The valves are all in the heads, without cages and are operated by a single camshaft lying above the cylinders, which camshaft is driven from the crankshaft by a vertical shaft through worm gears—spirals at right angles—and the whole mechanism, shafting, gears, camshaft and valves—is completely inclosed and copiously lubricated.

Six Cylinders Cast in Block

The six cylinders are cast in one block together with the entire crankcase and the intake header. The cylinder head is another unit and carries all the valves and the camshaft, while covering it is another smooth plate that makes an oil-tight housing for the valve mechanism. Even the water pipes have been eliminated, the radiator being bolted to the motor itself without any rubber connections.

The valves are large considering their location in the head, having an outside diameter of 1 15-16 inch and a clear opening of 1 21-32 inch. There are no cages, the valves seating right in the head casting. Each valve overhangs the cylinder bore slightly, so that in the event of a stem breaking the valve would not fall into the cylinder.

There are no rocker arms used, the camshaft being right above the ends of the valve stems; but between the cams and the stem ends is the end of a very light steel finger pivoted at the

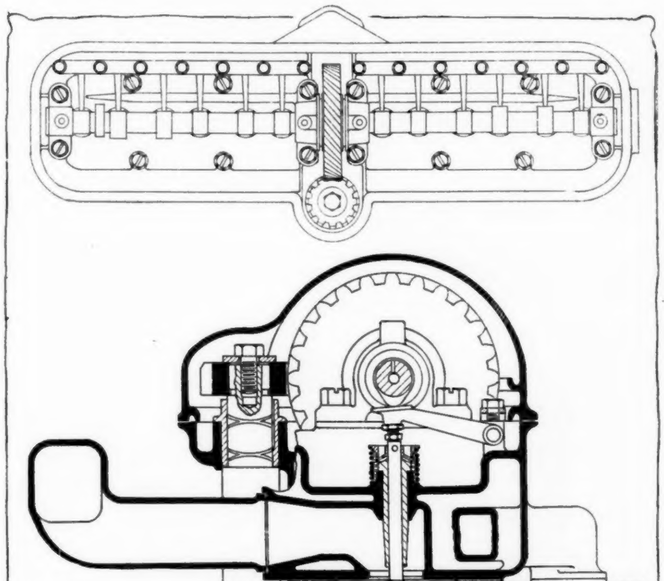
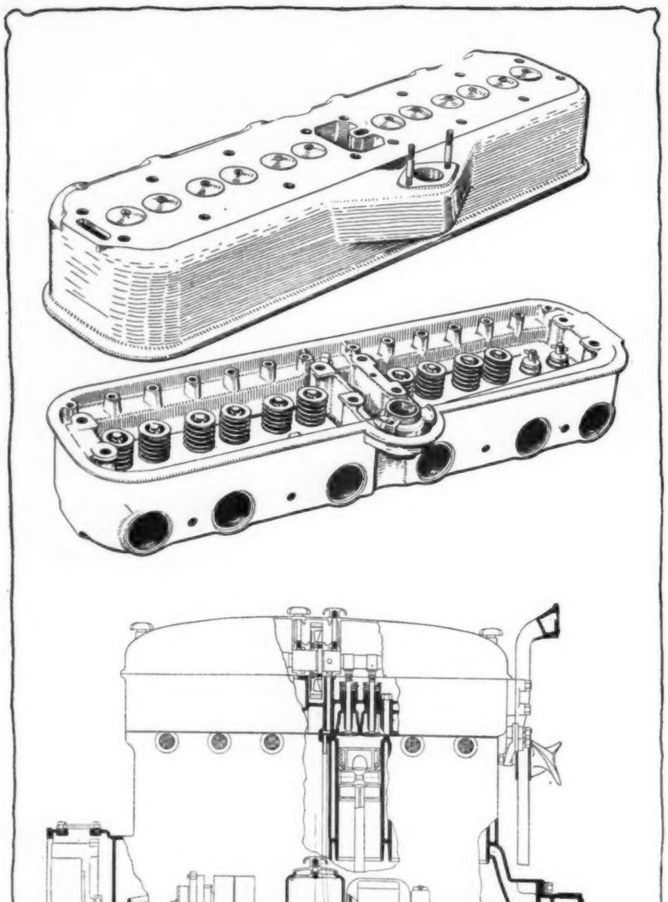


Fig. 2—End section of Weideley motor, together with plan showing how camshaft is driven by central gear mounted between third and fourth cylinders. The tapered water-jacket spaces on the cylinders are shown, these extending well to the bottom of the cylinder bore.



Details of New Premier Motor

Fig. 4—Views of the Weideley valve-in-the-head motor. At top—Valve arrangement with cover plate removed. In center—Part section through motor showing intake and exhaust location in cylinder head and mounting of magneto and generator. Lower center—Base plate of motor ribbed to assist in cooling the oil. Bottom—Six oil troughs into which the connecting-rods dip

other end. This carries the adjustment by which wear can be taken up and replaces the usual valve-stem adjustment.

Valves and fingers are so much lighter than the ordinary long-stemmed valves and their tappets that the valve springs are 20 pounds weaker than usual, meaning less wear and less noise. The finger arrangement does away with all side thrust on the valve stems. The aluminum cover plate is held on by 4 small hand wheels.

The Remy cranking motor is carried behind the rear motor arm, a sliding gear meshing with the flywheel gear for starting.

The Remy starting and lighting generator, the Eisemann magneto and the water pump are driven by a gear like that on the crankshaft but located outside the vertical shaft gear so that these instruments are parallel to and on a level with the crankshaft. Mounted on the pump shaft is a pulley for the fan belt.

Oil Distributer Used

Among the interesting motor details is the oiling system. It is a combination of pressure and splash cared for by a gear pump bolted to the crankcase and driven from the bottom of the vertical shaft. The oil is distributed by a rotating sleeve on the top of the pump. Equal parts of the oil are sent to each of the six troughs into which the connecting-rods dip through a passage cored in the bottom plate and one part to the valve mechanism. Lubrication of the camshaft bearings and cams is accomplished by means of a hollow camshaft which is supplied with oil from the distributor by a pipe running to the center bearing. The bearing is grooved and the camshaft is drilled so that passage of lubricant to the bearings is uninterrupted. The end bearings are lubricated by holes drilled in the camshaft at these points. The rest of the valve mechanism is bathed with oil by streams that issue from the backs of the cams. The oil then drains toward the center of the cylinder head and falls back to the crankcase through a hole in the casting. In the center of the cylinder head casting is a well in which the camshaft gear revolves and the oil from the camshaft bearings keeps this filled so that the gear turns in bath of oil as does the gear on the vertical shaft and its bearing.

On its way to the crankcase the oil falling from the top of the motor strikes the gear in the middle of the crankshaft, also filling the two middle main bearings next to the gear. Troughs on the sides of the crankcase lead the splashed oil to the end crankshaft bearings. Leakage at the end bearing is prevented by a thrower ring and troughs in the flywheel housing.

One of the ideas of design throughout the motor is the small number of parts, obtained by making one with a number of distinct functions. An instance of this is the pump water, the casting with which it is incorporated serving a number of purposes. It forms the pump housing, the water connection from radiator to pump the connection from pump to motor, the starting crank bearing, the radiator support, front motor support, and holds the adjustable thrust bearing at the front end of the crankshaft.

The upper water connections likewise is a multi-function part. This casting has a downward projection which supports the fan and provides an adjustment for the fan belt tension. The radiator is supported only by the top and bottom water connections, and there is no rubber hose. The radiator thus has a two-point support and is unit with the motor so that it is not affected by twisting of the frame. The fan is the two-bladed aeroplane propeller type.

Crosshead Pistons Used

A unique type of piston is employed, called crosshead pistons. They are so designed that the part taking the pressure of the gas is separate from that which serves as a guide. Piston head and ring grooves are formed as usual, but there is a slot .25 inch wide between the head and the skirt. The bosses are linked to the head by two crescent-shaped webs, thus no heat is transmitted from the head to the skirt and the head proper is kept cooler. The form result permits very small clearance on the skirt, .0015 inch so that there is no chance of piston slap.

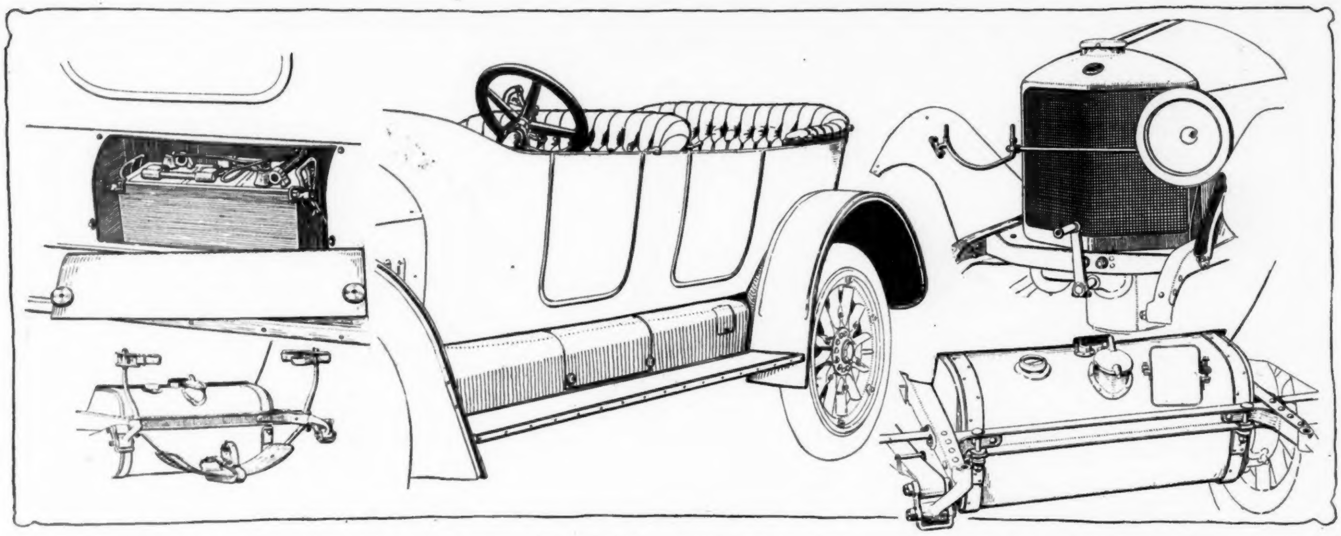


Fig. 5—Details of the Premier body. At upper left—Battery mounting between running board and body under apron. Lower left—Details of tire carrier. Center—Body lines showing cowl. Upper right—Lamp bracket supported on fender and V-type radiator. Lower right—Supporting method used in gasoline tank, together with section of tank showing continuous bands for supporting it

Premier precedent is shattered in another respect. This is in the unification of the power plant in the new design. In this they have gone beyond the practice of the strongest supporters of the unit power plant in making it complete by the incorporation of the radiator as a part of the unit.

The crankshaft has four bearings, though with a three-bearing simplicity, the two middle bearings both being between the third and fourth cylinders.

All the main bearings are 2 inches diameter, the lengths being 2 9-15 inches for the front, 1 5-8 inches for the middle ones and 3 3-4 inches at the rear. The connecting-rod bearings are 2 inches diameter and 1 3-4 inches long. The gear driving the vertical shaft is fastened on a flange formed integral with the crankshaft. The shaft is supported at this point by two main bearings, one on either side of the gear.

While the camshaft bearings are solid bushings, the crank bearings are capped in the usual way, and provided with shims of varying thickness to permit easy adjustment. The vertical driveshaft has a Timken taper roller bearing at its lower end which takes the running thrust, with a plain thrust bearing to hold the shaft in case the motor is allowed to kick back in starting. The shaft is inclosed in a tube, and oil working past the upper bearing, which is plain, serves to oil the lower bearings.

Four-Bearing Crankshaft

The camshaft is carried on four bearings mounted on the cylinder head and is 1 3-16 inch diameter. The end bearings are 1 1-4 by 1 3-4 inch long, and the middle ones, which are either side of the driving gear, are 1 3-4 by 1 5-8 inch long. A hole 3-8-inch in diameter is drilled through the camshaft for its entire length, and carries oil to the cams and the end bearings.

Weidley's new motor is Premier's answer to the high-cost-of-motoring question, in spite of the fact that the fuel consumption is the objection oftenest urged against the six-cylinder car. Twenty-two miles per gallon of gasoline on city streets in a touring car with four people up is the record held by this new six, whose cylinders are 3.625 by 5.5.

New Motor Is Economical

With gasoline economy as the aim, Weideley designed his new motor with valves in the head, which arrangement generally is credited with being the most efficient. At the same time, he got away from the chief objections to the valve-in-head construction, those of expansion, weight of long push rods and rocker arms by locating the camshaft right over the valves. He got away from another objection, that of noise, by putting a cover over the whole mechanism, and then provided against wear in the outfit by feeding oil to every friction part.

As to speed, a test on the motor speedway developed 70 miles per hour with three people up, but when they took The Automobile man out for a run on Millersville Pike through rolling country the new car exhibited a more important characteristic than that of speed: Johnston's hill, the negotiation of which without gear shifting is considered a feat, was selected as the testing ground. The speedometer registered 18 miles per hour at the bottom, 22 at the middle and 18 at the top—on high speed all the way. The essentials of the rest of the chassis do not differ greatly from previous Premier construction.

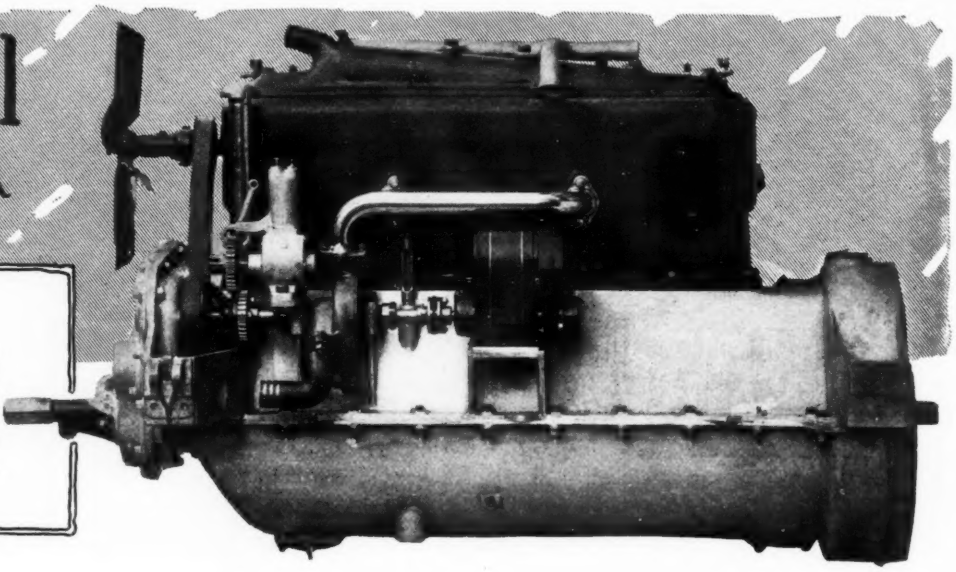
The multiple-disk clutch is continued. The new gearset is a three speed one with the control levers in the center and the driver on the left as formerly. The rest of the chassis is unchanged except the springs and frame. Rear springs on the new car are one-half elliptic instead of three-quarter to reduce sidesway. The side members of the frame are straight, except for an upkick over the rear axle, but there is no necking in. However the frame is tapered, the width at the front being 6 inches less than at the rear. There are only three cross-members, one at the front of the motor, one forward of the rear springs and another at the extreme rear. But rear arms of the motor form a most substantial brace for the frame. The fuel tank is at the rear instead of under the seat. Mudguards follow the contour of the wheels and are narrower than formerly, and to eliminate squeaks are not fastened to the running boards. The battery is hidden under the left apron where it is accessible.

The hood is remarkably short for a six, misleadingly so, in fact, for no one would recognize it for a six from the appearance of the bonnet. The latter has a very decided taper to the pointed radiator. The whole body has very smooth lines and the sides are particularly high. Wheelbase is 132 inches, tires are 36 by 4.5. This chassis will be fitted with two-, four-, five- and seven-passenger bodies.

Norse Mine Output Increases 35 Per Cent.

The mineral and metal output of Norway in 1912 shows about a 35 per cent. increase both in value and in number of men employed, but it should be noted that the increase is practically confined to those propositions which began working before restrictions of the concession laws became operative some 5 years ago. At that date all appreciable progress in new mining ventures practically ceased. So far as the 1912 output and values are concerned, it may be pointed out that apart from the 44,500 tons output of the Salangen iron mines (which shut down in that year), the bulk of the iron-ore output as represented by Sydvaranger, is not dividend-paying.—From *The Engineering and Mining Journal.*

National Bringing Out a SIX



Has Block Cylinders of L-Head Type 3.75 by 5.5 Inches — Price $2,375 — Many New Features — Model 40 to Be Continued.

AFTER several months of rumors as to appearance of a six-cylinder car at less than $2,500 from the National Motor Vehicle Co.'s factory, such a car has appeared. It is of the popular light six type, with a motor of the conventional cylinder dimensions of 3.75 inches bore and 5.5-inch stroke. Also, like many of the new sixes, this latest one has its cylinders cast in a single block and of the L-head type, both intake and exhaust valves being on the right side.

In both respects, that of the method of casting the cylinders and that of their shape, the new six differs from former National practice. The Model 40, the sole chassis model which has carried the National flag for the past year and the one which probably will be the chief factor in the company's production program for the future, has its cylinders cast in pairs and these are of the T-head type, employing two camshafts with the valves on either side of the cylinder.

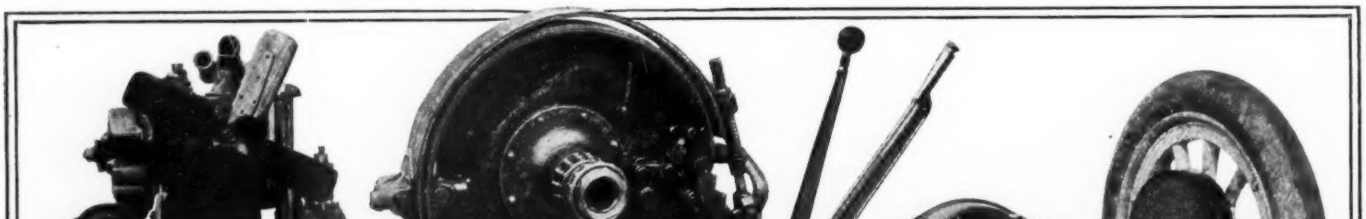
In its selling policy as well as the mechanical features, the National company has adopted a rather unusual method. It is the belief of Geo. M. Dickson, general manager of the company, that the prospect is more vitally concerned in the character of the maker and the responsibility than with many of the minor details that it is sufficient to show the buyer that the factory has the kind of a car he wants and the responsibility of the factory and the good judgment of its engineers may be relied upon to provide the proper material to make it stay that way. His idea is that buying a car is much like buying a high grade watch—the maker's name is sufficient guarantee of its proper material and design.

True Streamline Body Used

Not only in its entry to the six-cylinder ranks does the new car prove an innovation for the National; it is remarkable also for the exceptional sweep and cleanness of its body lines. The hood tapers from the radiator back without a break, the taper seemingly beginning as far back as the front seat.

A third innovation and one almost as radical as the adoption of the sextuple engine is the cantilever type of rear spring suspension which is employed. This is somewhat similar to the Lanchester suspension, but differs from the latter in that the entire thrust of the drive is taken through these springs. This is probably the first attempt to use a cantilever spring as the propulsive member. National springs are 5.3 inches long and hung at the front end from a double shackle.

The motor of the new car whose cylinder bore gives it a rating of 33.75 horsepower, transmits its power through a cone clutch with a three-speed gearset located amidships of the frame. An uninclosed propeller shaft with a universal at either end carries the power to the floating axle and a large torque arm takes up the twisting action. The car is 132 inches between wheel centers and tires are 36 by 4.5. The steering wheel is located on



Features of the new National six: At left, front elevation of motor. Center, brake and drum, bolted-on hub cap and three-speed gearset. At right, rear axle, showing universal for driveshaft and strong torque arm

the left side, while the control levers are in the center and placed well back toward the seat, where they are least in the way.

All Manifolds Are Detachable

In conjunction with the block cylinder casting is used a detachable intake water header, while both intake and exhaust manifolds likewise are detachable. The intake manifold is water-jacketed, to improve the vaporization of the present low grade fuels.

In the cooling system there are some special features. The radiator, of National design, has been improved in efficiency somewhat, so that it can be made slightly smaller, and thus assist in obtaining the smart slope to the hood. The radiator is mounted upon trunnions on the frame horns to prevent damage from twists, due to road inequalities. The cooler is assisted by an adjustable ball-bearing fan mounted on a standard from the engine base. On the fan pillar is provided an adjustment for keeping the belt tension. The circulation of water is carried on by a rotary pump on a layshaft driven from the timing gears. These are spiral-cut and operate in a bath of oil. The layshaft carries in turn from front to rear of the motor a fan-belt pulley, the tire pump, water-pump and lastly, through a flexible coupling, the magneto.

The crankcase is divided horizontally and the combination of splash and force feed oiling is maintained by a gear-driven pump. This keeps a constant level, into which the connecting-rods splash for cylinder lubrication and the main bearings are oiled through tubes cored into the casting. These tubes also lead oil to the forward end of the motor for the timing gears and for the lubrication of the silent chain, which runs in a bath of oil to drive the Deaco electric generator and cranking motor. The latter, though separate units, are mounted as a single piece upon the valve side of the motor, and at its forward end, the silent chain of unusual breadth running to the crankshaft. The method of mounting the electric units for which a special base-plate is cast on the engine, makes the apparatus almost a part of the engine, so that it does not give the impression of being an afterthought. The cranking unit is thrown into action by a small foot plunger, while the generator action is automatic.

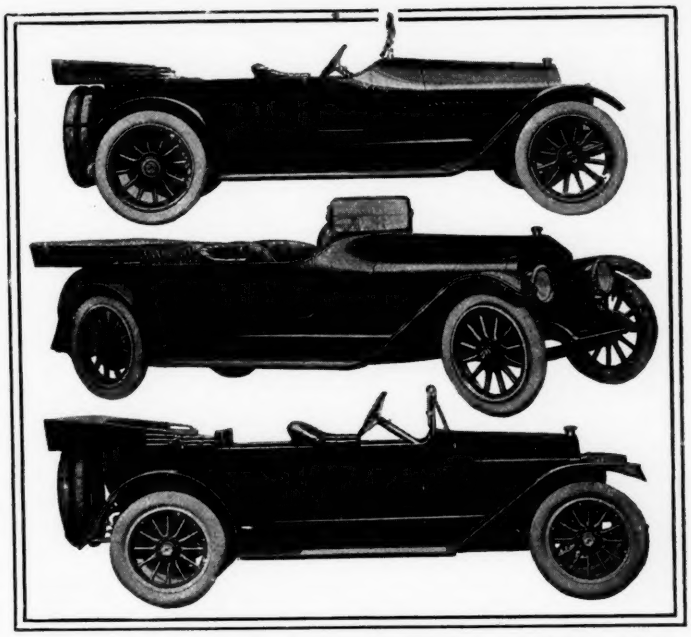
Ignition is obtained by a high-tension magneto of the dual type. The Rayfield carbureter is fed by pressure from a 22-gallon tank hung at the rear end of the frame. This pressure is maintained by a small piston type pump operated by a special cam on the camshaft. A power tire pump is built into the motor.

Aluminum Cone Clutch

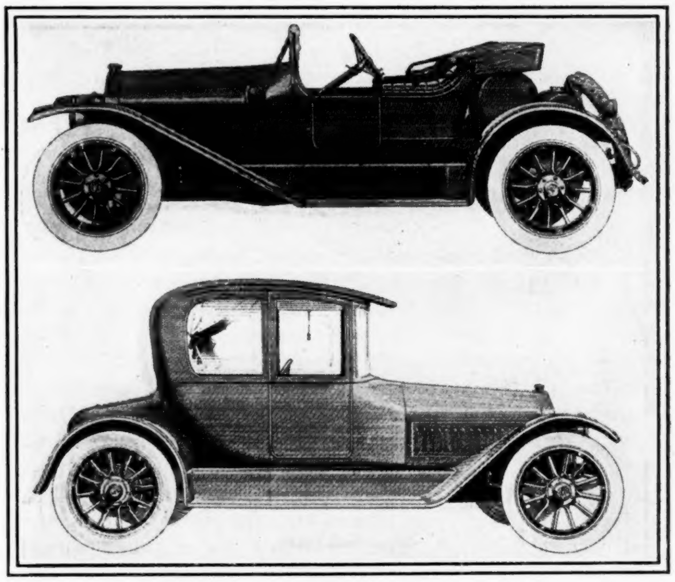
Within the flywheel is the aluminum cone clutch, with a leather face which is spring-cushioned, to give gradual and easy engagement. The clutch is removable without disturbing the rest of the transmission. This feature is obtained by the employment of a double universal in the short shaft between the clutch and gearset, and is one of the time-tried features of National construction. The clutch pedal is adjustable to give slight variations in the clutch action and spinning is prevented by a clutch brake consisting of two pads which bear on the rim.

The braking system includes two internal expanding hub brakes and two external contracting brakes on the outside of the drum. These drums are 16 inches in diameter. The frame is particularly sturdy in construction. It is 5-inch channel section, with exceptionally wide flanges, curved up over the rear axle to permit low body suspension. The frame is offset in front to permit turning in a 39-foot circle. The front axle has large adjustable roller bearings in the hubs. The rear axle also has roller bearings.

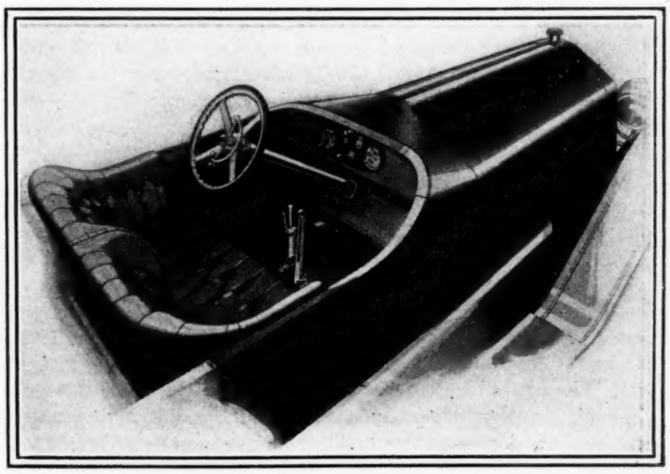
The control features consist of an instrument board in the cowl, upon which are grouped the switches and indicators, all within a metal plate. A dash control of the carbureter is provided. The electric horn button is carried in the top of the steering column, where it may be quickly sounded. The bodies fitted upon the new six-cylinder chassis include a four-passenger and a five-passenger touring, and a three-passenger coupé. The touring cars are listed at $2,375, and the coupé at $2,850.



Top—New National six, five-passenger touring car, selling for $2,375. Note the streamline body
Middle—Four-passenger edition of the new six-cylinder addition to the National line
Bottom—The four-cylinder, 40-horsepower National as a seven-passenger touring car



Upper—National four-cylinder, 40-horsepower speedway roadster
Lower—New six-cylinder National coupé. Price $2,850



Control features and instrument board of the new six-cylinder

Fuel Consumption by Electric Generator

Trego Claims Misunderstanding of Conditions in Packard Test—Comments by Electrical Engineer and Starter Man

DETROIT, MICH.—Editor THE AUTOMOBILE:—There seems to be some misunderstanding about the tests which were made by our company on the Long Island Motor Parkway, as to the gasoline consumption with and without electrical equipment. In the letter from R. H. Coombs, published in THE AUTOMOBILE for December 11, he seems to be misinformed as to the manner in which the car was handled during any given test. Each test was conducted as follows:

The gasoline measuring tank was filled until it contained exactly 1 gallon of gasoline, with the car standing still. Valves were open to connect this tank with the carbureter. It should be remembered that the tank, as well as the pipes leading to the carbureter and the float chamber of the carbureter were full of gasoline.

The car was then started and accelerated to the required speed and maintained at that speed until approximately half the gasoline was consumed. The car was then stopped and turned around on the narrow Parkway, which required more or less backing and gear work; was again accelerated up to required speed in the opposite direction and the mileage noted when the gasoline flashed past the narrow neck at the bottom of the measuring tank. The car was not allowed to coast during the entire test.

It is readily seen that the above certainly would consume more gasoline than running around the easy curves of the Indianapolis Motor Speedway. It is also readily seen that the consumption would be greater than in straightaway test, where the beginning of the tests are at a speed noted in the test, rather than at a standstill.

It must also be remembered that the motor was cranked for approximately 25 minutes in order to discharge the battery enough to require 17-18 amperes output from the generator. This, of course, would not be the case under normal operating conditions, as the generator keeps the battery fully charged; so that under normal conditions, during the daytime, the consumption would be very much less than shown by the test, owing to the fact that no lights would be burning and the battery would be fully charged, and even at night, the normal conditions would be more favorable than the test, as the battery would not be discharged to such an extent as in the test and the lights requiring 10 amperes output would be almost the entire demand on the generator.—F. H. TREGO, Research Engineer, Packard M. C. Co.

Electric Lighting Worth the Money

SANDY HOOK, CONN.—Editor THE AUTOMOBILE:—We have read with great interest R. H. Coombs' criticism of the Bijur-equipped Packard 38 lighting fuel consumption test on the Long Island Parkway, and feel that he is warranted in using it as a defense for his Indianapolis Motor Speedway data. The writer was not one of the parties who pooh-poohed Mr. Coombs' tests, but it will not be a difficult matter to explain the fallacy of this form of testing the gasoline used for electric lighting equipment. Before undertaking this, it should be stated as a qualification of our criticism that we have had a great deal of laboratory, road and general engineering experience with carburetion research and development work, together with motor and chassis design. In addition, we are manuafcturing a combined, unit, single-driven, air starting and electric lighting equipment, in the development of which we have covered all the ground these tests have stirred up, and know that the factors mentioned above are of such influence that to be frank we do not think that either Mr. Coombs' test or that of the Packard is accurate in a measurable degree necessary to form a true conclusion.

Fuel Consumption Always Varies

Firstly, we claim that it is practically a physical impossibility to drive a car over a given distance twice on the same fuel consumption. More particularly is this true as the distance becomes relatively short, because here you lose the effect of the laws of average. As evidence of this, we would call attention to the figures of the Packard test, wherein the first run with the generator attached was 13 miles, and the checking run 13.20. If the car be driven by the wheel throttle, the result on a long straight stretch is somewhat better, but if driven by the foot, there are physical, nervous influences at work which result in increments of throttle action, resulting in admission of many small puffs, not adding to the kinetic energy equation of the car, but causing a considerable consumption of gaseous charge nevertheless.

Secondary influences on carburetion are the diurnal and hourly barometric changes, multiplied and compounded by atmospheric stratification, and localized temperatures. We have run cars upon rail tracks under conditions especially favorable to duplication of physical conditions but we have never been able to run one accurate fuel consumption test identical with the immediately preceding one. In the laboratory, a motor will alter its delivery momentarily without being touched in any way by the operators, and these variations can be appreciated if the equipment is designed for their apprehension.

Our laboratory test sheet, shows the entries we record of existing variables in work of this character, so that it will be seen that cognizance is taken of any influence measurable while the engine is in motion. With all the entries but those of the fuel weights run to a constant value, within reason, we have detected variations in power output and the chemical reactions of combustion which show conclusively that the weight of fuel consumed varies materially both on the block and to a greater degree under the foot in the open air.

Secondly, and resultantly of these facts, we claim that a road test such as those reported cannot be run so that it will give a true knowledge of the question. Especially true is this for the short distances tried, while if the mileage of the tests be extended, it seems to us that the time of day would be so much different that atmospheric and barometric changes would again upset the result. It is not for a moment our intention to claim that consumption is not affected, but it is extremely difficult to get at a figure not suffering from unavoidable influences.

Thirdly, it should not be permitted to assume that whatever consumption is arrived at can be charged to a continuous waste, which seems to be the accusation of Mr. Coombs. At times when our pump is not filling the tank, and when the lamps are

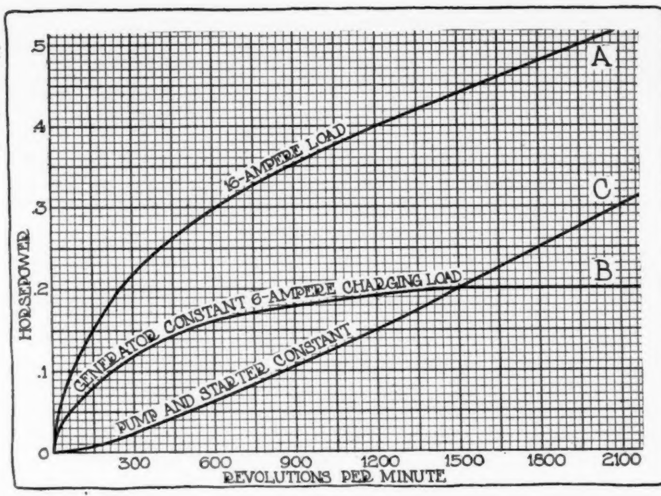
not lit, the power necessary to drive our equipment falls to a very low point, as will be seen by reference to the accompanying curves, Fig. 1, but if it is said that a certain percentage of the fuel is being used to light the lamps, it must be recognized that under identical conditions we should also be burning acetylene gas, and therefore it is more logical to compare the following premises.

No. 1—Cost per horsepower-hour of the power necessary to drive the generator under head, side, tail and dash lamp illumination.

No. 2—Cost per hour for acetylene for head, side, tail and dash lamps.

It should now only remain to measure the free running absorption power of the generator and compound it with the figure for horsepower cost under premise No. 1. Here is a figure which is affected by the individual merit of any particular design, since the specifications for other items, such as keeping the starting battery fully charged, cause a drag, not chargeable by right to the lighting equipment. Our own machine, as we have stated, is an air equipment and lighting generator within a unit case and through drive, so is connected tandem with the water pump or magneto at engine or six-cylinder magneto speed. This makes the curves we will presently refer to intelligible. Curve C, is with the generator armature removed, and Curve B with the air starting equipment removed. Number C, however, has nothing to do with lamp load.

It is a condition which the writer regards as indispensable that the lighting generator be capable of assuming whatever load existant—whether lamps or other devices—at the lowest speed the motor can idle. Otherwise the battery will help out at low speeds, so it cannot be proportioned to light certain lamps for so many hours, being-saddled with additional and uncertain work. If, on the other hand, it cannot discharge under any condition of engine running, the generator need only charge it at a low rate, compensating for local action, temperature variation, and general leakage. The return of charge lost while the car is standing cannct be included, because under equivalent comparison we would use acetylene.—C. S. Cole, Chief Engineer, Electrical Engineering and Storage Battery Co.



A—Horsepower speed curve. B—With starter removed. C—With armature removed

Electric System Costs $1.42 Per Year

Hoboken, N. J.—Editor The Automobile:—Concerning the Packard test of the Bijur electric generator made on the Long Island Parkway a week ago to determine the consumption of gasoline of the electric generator, I cannot but agree with Henry B. Joy of the Packard Company, who, commenting on the test and its results, said:

"The efficiency tests made the conditions grotesquely severe, in order to be able to show under the most severe conditions of use that it costs something to operate. Otherwise the test would not be believed. The club's official report of the tests shows that at 20 miles per hour the cost would be $7.88 per year for lighting and cranking, and at 40 miles per hour would be $6.38 per year for lighting and cranking, measured in gallons of gasoline consumed.

"These tests were made with a discharged battery to start with, in order that some cost of operation might show, and were also made with all lights burning all the time, and the figures are based on 10,000 miles of service within the year. The average cost between the two rates of speed is $7.13 per year.

"The generator throughout the test was giving out from 17 to 18 amperes constantly. In my opinion, the work of that generator in any ordinary service would be between one-fifth and one-tenth of the burden which was put upon it during these trials. Therefore, the actual cost of operating the electrical cranking and lighting system on our cars in general use would be somewhere between one-fifth and one-tenth of $7.13, or between 71 cents and $1.42 per year, or per 10,000 miles of driving. If that is reduced to monthly expense, based on my above assumption, the cost of operation becomes 6 cents to 12 cents per month. It therefore becomes obvious that the cost of operation is absolutely a negligible item, also that the power consumed is entirely negligible.

"In connection with this cost, it must be borne in mind that if you do not have electric lighting you must have some other form of lighting, which would obviously cost more; and if you do not use electric cranking you must either resort to hand cranking or some other kind of cranking which also would obviously cost more. Therefore, it is perfectly clear that the cost of operating any other method now known of lighting or cranking would entirely offset the cost of battery maintenance."

I might point out that the Bijur generator was, during the test, giving much more than its ordinary output, since it was supplying current to all the lights and to a discharged battery. Under these conditions, the test shows that the generator supplied not only the current required by the lights but an additional 7 or 8 amperes to the battery. This heavy current supply in time of need results from the method of generator regulation used in the Bijur apparatus, and is exactly what is wanted in order to rapidly restore a battery that has been discharged.

It must not, however, be supposed that this current would persist after the battery had become full or after the lights have been turned off, because then the generator automatically reduces the charge to about 4 amperes, which would be the ordinary current flow under day running conditions. With a current output of about 4 amperes, the power consumption of the generator would be only a fraction of the power required when it is furnishing 17 amperes.

Furthermore, the test brings out that the operation of the generator is precisely the best possible for the best care and preservation of the storage battery, as was shown by the fact that immediately the generator was started it relieved the battery of furnishing current to the lights, and, at the same time, proceeded to recharge the battery at a good rate.

Anyone familiar with storage batteries must realize that this is exactly what the battery requires, coupled with a very low rate of charge when the battery is practically full. The same method of handling large storage batteries in large stationary plants and in railway train lighting, has shown that the life of a storage battery under this treatment extends over many years.—W. C. Allen, Bijur Motor Lighting Co.

The AUTOMOBILE

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$2,777,000,000 from Crops

IN spite of all the talk of poor crops throughout the West and tight money markets, the government's final crop report shows the value of the five leading cereals, corn, wheat, oats, rye and buckwheat, to make the amazing total of $2,777,000,000. These figures in themselves are meaningless to many, but when it is realized that this crop value is $215,000,000 above that of 1912, some flesh and blood tone is added to the grand total.

This $215,000,000 of crop value for 1913 in excess of 1912 should mean much to automobile manufacturers, particularly those selling medium-priced cars and low-priced machines which are popular with the agricultural classes. With this $215,000,000 extra crop value you can buy 143,333 automobiles at a selling price of $1,500 each. But this price is above the average price of the American car for 1914. Put the average at $1,000 and you have additional crop value to purchase 215,000 of such machines. Carry the average car value to $800 and you can buy 268,750 of these machines.

Killing the Rumors

These figures should do much to dissipate the rumors of hard times in many of the Central West states in which the buying possibilities are solely dependent on crop conditions, and these figures but substantiate the assertions made in these columns within the last month to the effect that the great corn-producing states have not been demoralized by the drought of the past summer. One example might be cited in Kansas in which the continued drought brought about a water famine of such grave consequences that the cattle were marketed in unprecedented numbers at the Kansas City stock yards, but without a break in the price of beef. Many interpreted this as meaning an absolute failure of the wheat and corn crop, but the government figures in the final report of this week show otherwise. The corn crop alone for 1913 is the greatest ever produced, having a valuation of $1,692,000,000, or $40,000,000 over the crop of 1909, which was the largest previous corn crop in the history of the country.

The story of the wheat crop is no less interesting than that of the corn in that it establishes a new record, being the greatest crop ever harvested. In bushels it measures 763,380,000 as compared with the previous record of 1901, which measured 748,460,000. When we compare the wheat crop of the present year with that of 1912 we find an increase of over 33,000,000 bushels. The government places a valuation of $610,000,000 on the present wheat crop, as compared with $555,000,000 in 1912. In other words, there is an increased money value of wheat alone of $55,000,000 and this in spite of the persistent rumors of entire crop failure in not one but in several of the western states.

The oat crop shows a slight decrease as compared with 1912, but a big increase as compared with 1911. The oat crop for 1913 is valued at $439,000,000, as compared with $452,000,000 for the previous year.

Consider the Farming Districts

Let every motor car manufacturer weigh the real value of these figures to his industry. While he is doing this let him turn his back to those isolated population centers where Wall street holds sway. Let him see the buying status of America in its true light. To properly gauge the automobile-buying possibilities of America for next year, you must give the agricultural community its proper perspective.

These real facts of carloads of cars being shipped to the West, which have been doubted by not a few skeptics, will become more frequent realities within the next few months. This record-breaking crop situation accounts for the Detroit factories producing more cars today than they were 1 year ago, this notwithstanding the malicious gossips of the job-seekers, who, during the last 6 weeks have been going in and out among the industry scattering wide the seeds of venomous reports in the hope that they themselves might land in some position, which they are entirely unworthy of and which they are quite inadequate to fill.

The Symmetrical Chassis

THE 1913 chassis lacked symmetry in the general arrangement of motor and other appurtenances as compared with previous chassis models, a condition largely due to the necessity of adding starting motors and battery charging generators at the eleventh hour. For 1914 there should be a general improvement in chassis layout as engineers should now be convinced that both of these elements have come to stay or at least must be recognized as integral chassis parts until some better creations take their place. There is a dynamic force in the symmetrical chassis. This is one car part in which art can be combined with science to the best advantage.

Big Preparations for New York Show

Decoration Scheme To Be That of a Corinthian Court—Six Electric Vehicle Makers Get Space—Seventeen New Accessory Exhibits

NEW YORK CITY, Dec. 16—Judging from the decorative plans for the Fourteenth National Automobile Show in the Grand Central Palace, January 3-10, which were announced early this week by Manager S. A. Miles, it is evident that the interior of the Palace will be artistically arranged. The main decorative idea will be that of a Corinthian Court.

Several thousand bunches of smilax will be woven into streamers, and these will encircle the mammoth Corinthian pillars on the main floor. All the lattice work which now exists in the Palace interior will be covered with natural vines and foliage. The ornamental balastrade which surrounds the court on the second floor will be augmented with trailing foliage.

Although located on three levels, the exhibition hall of the Palace has been treated architecturally as to have the aspect of a spacious amphitheatre. Near the centre a large court rises to a height of 40 feet, through the second and third levels. This opening is 136 by 104 feet in the second floor and 85 by 40 on the third floor. The bulstrade surrounding the court on the second floor, together with the massive columns that rise to the third floor level, give the effect of a mezzanine floor gallery.

A grand marble stairway 60 feet wide, built on three terraces, leads from the main entrance on Lexington avenue to the main floor. From the head of this stairway there is a vista of 190 feet between the columns to the great windows at the rear of the building. A distance of 11 feet between the columns will afford a wide aisle for the centre promenade at the show. There are four stairways at or near the corners of the hall which lead to the mezzanine floor and third floor. These are inclosed by fire-walls and metal doors. The building is fire-proof throughout.

Electric Vehicles Allotted Show Space

NEW YORK CITY, Dec. 16—Early this week six electric car manufacturers were allotted space for the Grand Central Palace show, which is to be held under the auspices of the Automobile Chamber of Commerce, January 3-10. The concerns are: Anderson Electric Car Co., Baker Motor Vehicle Co., Rauch & Lang Carriage Co., Waverley Co., Ohio Electric Car Co. and the Ward Motor Vehicle Co. The electric car display at the Palace will be a comprehensive one and will give the followers of this type the first real opportunity to see the newest wrinkles in construction for 1914. Particularly to New Yorkers will the exhibit appeal, as the electric was conspicuous by its absence at the Electrical Exposition last fall.

Seventeen new accessory exhibits were added to the Palace show list this week. They are: H. W. Johns-Manville Co., the Gem Supply, Gray Pneumatic Gear Shift Co., Marathon Tire Sales Co. of New York, Universal Machine Co., Warm Hand Steering Wheel Corp., Inc., Peter A. Frasse & Co., Inc., Schaefer Sales Corp., Stewart & Co., Trenton Brass & Machine Co., Philadelphia Storage Battery Co., Wasson Piston Ring Co., Motor Patents Co., Western Electric Co., Cyclecar Age., Hall-Thompson Co. and the George W. Houk Co.

Knight and Martin, of Daimler, Here

NEW YORK CITY, Dec. 15—Charles Y. Knight, inventor of the Knight sleeve-valve motor, has arrived from his Coventry, England, home to attend the American shows at New York and Chicago and also to witness the coming test of the new Moline-Knight motor in its 2-weeks' run. Mr. Knight says that the recent Olympia show was the greatest car selling exhibition that England has ever had. The motor car business is in a much more healthy condition in Europe during the past few months, previous to which time it was quite demoralized in certain countries, due to the war.

Percy H. Martin, general manager of the Daimler company, Coventry, England, is at present an American visitor. Mr. Martin, in comparing the European car with the American machine, is of the opinion that American cars are entirely too heavy, much heavier, in fact, than European types. He is struck with the care shown on American machines in mounting of instrument boards and control pedal arrangements but in contrast with this points to the apparent lack of care in detail on motor accessories, wiring, etc. The American car lacks art in this respect.

S. D. Waldon and M. J. Budlong, of the Packard company, returned recently from an extended European trip.

M. & A. M.'s New Members and Meeting Schedule

NEW YORK CITY, Dec. 16—The following concerns have been elected to membership in the Motor and Accessory Manufacturers: Dunlop Wire Wheel Corp., New York City, Grant-Lees Gear Co., Cleveland, O., Sulzberger & Sons Co., Chicago, Ill., and the American Gear & Mfg. Co., Jackson, Mich. This makes a record membership of 265.

The new meeting schedule during the New York show is as follows: Executive committee, 10 a. m., Tuesday, January 6, at the association's offices, 17 West Forty-second street; board of directors, 10.30 a. m., Tuesday, January 6, at the association's offices; banquet committee, following the board of directors' meeting, January 6; finance committee, 2.30 p. m., January 6, at the association's offices; eleventh annual meeting, 3.00 p. m., Wednesday, January 7, at the Waldorf-Astoria; sixth annual banquet, 7.30 p. m., Wednesday, January 7, at the Waldorf-Astoria, and the board of directors, 11.00 a. m., Thursday, January 8, at the association's offices.

Automobile Engine Manufacturers' Assn. Formed

CLEVELAND, O., Dec. 12—To promote spirit among automobile engine manufacturers, the Automobile Manufacturers' Assn. was organized Friday, December 12, at the Statler Hotel. The following officers were elected: President, Charles John, Wisconsin Motor Mfg. Co., Milwaukee; Vice-President, A. F. Knobloch, Northway Motor Mfg. Co., Detroit; Secretary-Treasurer, A. R. Clas, Falls Machine Co., Sheboygan, Wis. There were fifteen automobile engine factories represented at the meeting. The next meeting will be held at the Statler on December 29.

NEW YORK CITY, Dec. 15—Norris N. Mason, for 25 years sales manager of the Renault Selling Branch, Inc., has tendered his resignation, to take effect on the 20th of this month, to become President of the Henderson Eastern Motors Co.

Architect's drawing of decoration scheme for Grand Central Palace Show

G. M. Gross Sales Are $25,307,941

During First 4 Months of Its Fiscal Year Company Sold 18,078 Cars, Increase of 4,570

NEW YORK CITY, Dec. 16—Stockholders of the General Motors Co. have every reason to feel satisfied with the way in which the new year's business has opened up. The first 4 months of the current fiscal period, which began August 1, produced gross sales of $25,307,941, against $20,252,389 for the same months of 1912. This is an increase of $5,055,552, or 25 per cent.

During August, September, Octtober and November the company sold 18,078 cars, which compares with 13,508 in the same period of 1912, an increase of 4,570 cars.

The present management has steadily sought to make the factory operations less seasonal and the 25 per cent. gain in gross sales for the first 4 months is in large part due to a shorter factory suspension after the close of the 1913 fiscal year on July 31.

The last cash statement of the General Motors, December 4, showed $6,038,558 in the bank, or considerably over $1,000,000 more than a year ago at this time. The outstanding 5-year notes are now $2,000,000 smaller in amount than in 1912, so that the cash position of the company may properly be said to be $4,000,000 stronger than a year ago.

The number of employees on November 29 was 16,815, a small shrinkage from last year.

Packard Business Increases 22.6 Per Cent.

DETROIT, MICH., Dec. 15—A remarkable increase in Packard business for the last 4 months gives evidence of that company's steadily increasing prosperity. The figures are given in a statement issued by Alvan Macauley, vice-president and general manager.

"From August 1 to November 1, the increase in motor carriage sales was exactly 22.6 per cent. as compared with the corresponding period last year. When this is coupled with 28.6 per cent. increase in shipments, we feel that the Packard company has made a very credible showing and one which is perhaps unique among cars of the highest grade.'"

WASHINGTON, D. C., Dec. 16—*Special Telegram*—The Secretary of the Treasury has issued the following order, to collector of customs at Detroit. A drawback is hereby allowed under paragraph O of section 4 of the tariff act, of October 3, 1913, and the drawback regulations of June 16, 1911, on automobile designated as models 238 and 248, manufactured by the Packard M. C. Co., Detroit, with the use of imported ball bearings. The allowance shall not exceed the number of imported ball bearings appearing in the exported automobiles.

October Overland Business Gain 69.5 Per Cent.

NEW YORK CITY, Dec. 15—President J. P. Willys in a recent address said that the October business of the Willys-Overland Co. was 69.5 per cent. above the same month a year ago and its actual output of cars was 4,702. Its November sales were about 31 per cent. ahead of last year.

A. C. of C. Adopts Standard Warranty

NEW YORK CITY, Dec. 15—At the monthly meeting of the board of directors of the Automobile Chamber of Commerce, Inc., held on December 3, a standard form of warranty for passenger and commercial vehicles was approved. This is as follows:

THIS IS TO CERTIFY THAT we, the .... of ...., warrant each new motor vehicle manufactured by us, whether passenger car or commercial vehicle, to be free from defects in material and workmanship under normal use and service, our obligation under this warranty being limited to making good at our factory any part or parts thereof which shall within ninety (90) days after delivery of such vehicle to the original purchaser be returned to us with transportation charges prepaid, and which our examination shall disclose to our satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on our part, and we neither assume nor authorize any other person to assume for us any other liability in connection with the sale of our vehicles.

This warranty shall not apply to any vehicle which shall have been repaired or altered outside of our factory in any way so as, in our judgment, to affect its stability or reliability, nor which has been subject to misuse, negligence or accident, nor to any commercial vehicle made by us which shall have been operated at a speed exceeding the factory rated speed or loaded beyond the factory rated load capacity.

We make no warranty whatever in respect to tires, rims, ignition apparatus, horns or other signaling devices, starting devices, generators, batteries, speedometers or other trade accessories, inasmuch as they are usually warranted separately by their respective manufacturers.

IN WITNESS WHEREOF, the said company has caused this warranty to be signed by its duly authorized officers.

.... President.

.... Treasurer.

Date .... 191 .

O'Connor President of Pullman Co.

YORK, PA., Dec. 15—Thomas C. O'Connor, who about 10 months ago retired from active connection with the Pullman Motor Car Co., of York, Pa., in order to give attention to his extensive real estate interests in and about Greater New York, has rejoined the company and has been re-elected President. He again takes active control of the company's affairs, to which he is devoting his concentrated attention.

KOKOMO, IND., Dec. 15—On Wednesday evening, Byrne, Kingston & Co., and allied concerns, the Kokomo Electric Co. and the Kokomo Brass Works, gave a reception and banquet in their newly completed administration building. In all some 300 were seated at the tables.

Automobile Securities Quotations

A slight lowering of no importance, occurred in this week's automobile securities quotations.

	1912		1913	
	Bid	Asked	Bid	Asked
Ajax-Grieb Rubber Co., com	155	190	195	220
Ajax-Grieb Rubber Co., pfd	97	102	97	102
Aluminum Castings, pfd	97	100	98	100
Chalmers Motor Co., com	..	..	..	94
Chalmers Motor Co., pfd	..	..	90	95
Consolidated Rubber Tire Co., com	11	14	32	36
Consolidated Rubber Tire Co., pfd	54	60	100	110
Firestone Tire & Rubber Co., com	300	307	235	242
Firestone Tire & Rubber Co., pfd	105½	107	100	101
Garford Co., pfd	100	102	78	90
General Motors Co., com	32	34	35¼	37
General Motors Co., pfd	76	78	75	76
B. F. Goodrich Co., com	63	65	17	18
B. F. Goodrich Co., pfd	105	106½	75½	76
Goodyear Tire & Rubber Co., com	402	411	185	192
Goodyear Tire & Rubber Co., pfd	105	106	90	92
Gray & Davis Co., pfd	..	..	94	101
Hayes Manufacturing Co	..	90	..	..
International Motor Co., com	10	20	..	5
International Motor Co., pfd	40	60	..	14
Kelly-Springfield Motor Truck Co., com	..	..	40	60
Kelly-Springfield Motor Truck Co., pfd	..	..	90	105
Lozier Motor Co., com	..	..	..	16
Lozier Motor Co., pfd	..	..	..	90
Maxwell Motor Co., com	..	..	2½	3
Maxwell Motor Co., 1st pfd	..	..	18¼	18[illegible]
Maxwell Motor Co., 2d pfd	..	..	6½	7
Miller Rubber Company	160	170	115	121
New Departure Mfg. Co., com	..	..	140	150
New Departure Mfg. Co., pfd	..	..	100	102
Packard Motor Co., pfd	104	106	90	95
Palmer & Singer, pfd	..	..	..	65
Peerless Motor Co., com	..	..	15	25
Peerless Motor Co., pfd	..	..	75	80
Pope Manufacturing Co., com	26	28	1	3
Pope Manufacturing Co., pfd	69	70½	10	15
Portage Rubber Co., com	..	..	..	30
Portage Rubber Co., pfd	..	..	..	85
Reo Motor Truck Co	9¼	9¾	5	7
Reo Motor Car Co	20	21	13½	14[illegible]
Rubber Goods Mfg. Co., pfd	103	107	105	115
Russell Motor Car Co., com	..	..	..	40
Russell Motor Car Co., pfd	..	..	..	70
Splitdorf Electric Co., pfd	..	..	40	45
Stewart-Warner Speedometer Co., com	..	..	55	57
Stewart-Warner Speedometer Co., pfd	..	..	95½	97½
Studebaker Co., com	35	37	17	18
Studebaker Co., pfd	90	93	65	67½
Swinehart Tire Co	100	105	65	70
U. S. Rubber Co., com	..	..	54	55
U. S. Rubber Co., 1st pfd	..	..	100	100¼
Vacuum Oil Co	..	..	191	194
White Co., pfd	104	109	105	110
Willys-Overland Co., com	68¼	68¾	58	62
Willys-Overland Co., pfd	99¼	99¾	81	85

Abbott Motor Car Co. Will Stay in Detroit

Making Extensive Alterations — Now Abbott Motor Car Co.—E. F. Gerber Assumes Direct Supervision

DETROIT, MICH., Dec. 15—Several reports that E. F. Gerber, who recently purchased the entire assets of the Abbott Motor Co., this city, had decided to move the plant to the vicinity of Pittsburgh were stamped as groundless in a statement issued to THE AUTOMOBILE December 12.

"The Abbott factory is not going to move from Detroit," says Mr. Gerber. "We are now making extensive alterations and changes in the plant, which will materially increase its capacity and minimize the operating expense."

There is, however, a minor change, in that the name Abbott Motor Co. has been lengthened into Abbott Motor Car Co., while Gerber himself has assumed direct supervision over the management of the concern. A. E. Schafer, who became President and General Manager when the creditors' committee took a hand under the old order of things, has retired from the concern, as has also L. B. Sanders, who was sales manager.

M. J. Hammers, chief engineer, is retained in that capacity by the new owner, as is the present manufacturing force.

Inasmuch as the purchase of the Abbott Motor Co. was a cash one, the new Abbott company enters upon its career with a clean slate and free from liabilities. Mr. Gerber states that in addition to the original purchase price, such further investments as the business needs will be added from time to time with the idea of discounting all bills.

In entering the manufacturing of motor vehicles, Gerber's experience is somewhat unusual. He has long been a dealer and distributor of automobiles and therefore sees manufacture from the dealer's angle. "Our experience for a number of years past has been in the selling of motor cars, not the building of them, and we are fully aware of the demands of the purchasing public," says he. "We know what is needed in a car to make it an easy-selling proposition; what the dealers should have in the way of discounts, service and sales assistance in order to make their business profitable. It is our intention to listen and cater to the demands of the dealers. They should know better than the factory what should be incorporated in a car."

This policy is rather new to the automobile game in just this form, although most engineering departments are governed to some extent by the ideas of the dealers.

Mr. Gerber states further that he has been in actual possession and control of the Abbott plant since November 25 and has furnished the money on which it has been operated for 30 days prior to that time. In the month of November, he says, the output of previous months was more than doubled, while he predicts a gain of another 100 per cent. for December.

The Abbott factory is operating with a force of 140 men at present, but it is expected that this number will be brought up to 200 within a very short time. The Abbott models will be continued with only slight changes.

Cannot Use the Name Gramm

WALKERVILLE, ONT., Dec. 12—The Fisher Motor Co., of this city, is restrained from using the name Gramm either alone or in combination with any other names in respect to motor trucks it may offer for sale. This company recently announced its intention of manufacturing trucks, and placing same on the market under the name, Gramm-Bernstein. The Gramm Motor Truck Co., then obtained an injunction restraining it from using this name, and has now received a judgment, restraining them from doing so.

Rajah Gets Injunction Against Rex Ignition

NEW YORK CITY, Dec. 12—The Rex Ignition Mfg. Co. is perpetually enjoined and restrained from substituting in a Rajah spark plug any part not sold by the Rajah company. On November 19 Circuit Judge Ward, of the United States Court of Appeals, rendered an opinion in the suit of these two companies, sustaining the validity of the Rajah company's restricted license under which its plugs are sold. They are sold under a license restriction that no porcelain or other part not made by the Rajah company shall be substituted in the plugs of that make. Various dealers have contended that this restriction was not inforcible. The opinion by Judge Ward not only sustained the validity of the Rajah restriction, but held that it was contributory infringement of the Mills patent, No. 825,856, to sell porcelains for substitution in the Rajah plugs, unless these porcelains were made by the Rajah company. A preliminary injunction was granted. Judge Holt has now given a full injunction against the Rex Ignition Co.

V-Ray Co. Takes Out Canfield Patent

NEW YORK CITY, Dec. 13—The V-Ray Co., Marshalltown, Ia., has taken out a license under the Canfield patent, No. 612,701. This makes the fifteenth new license issued on this spark-plug patent since the recent decision handed down, giving A. R. Mosler a permanent injunction on the manufacture of all spark plugs with a recess behind the electrodes and making practically every plug manufacturer an infringer.

C. P. Henderson Is Regal Vice-President

DETROIT, MICH., Dec. 11—The Regal Motor Car Co. has elected Charles P. Henderson to the Vice-Presidency of the company. Mr. Henderson was formerly a director of the Cole Motor Car Co., Indianapolis, and manager of its sales and advertising departments. He left the Cole company to take the Presidency of the Henderson Motor Car Co. at the time of its formation in Indianapolis. The Regal announcement states that the Henderson car will still be made on a conservative basis and that Mr. Henderson will continue as its head in an advisory capacity. He assumed control of the sales and advertising of the Regal company in an executive way on December 1.

Colonel Pope Only Receiver

BOSTON, MASS., Dec. 12—Boston interests have been unsuccessful in their efforts to have three receivers for the Pope Mfg. Co. appointed in the Connecticut jurisdiction as has been done in Massachusetts by the United States court. Judge William S. Case of the Superior Court has appointed Colonel George Pope sole receiver of the company in this jurisdiction, much to the satisfaction of the many friends of the Colonel in this vicinity. Connecticut interests have been opposed to three receivers. The faith expressed by Judge Joseph P. Tuttle in Colonel George Pope on his appointment as temporary receiver is reiterated by Judge Case. On Friday of last week, as reported, Judge Case took under advisement the proposition of the Boston faction for the appointment of three receivers. Judge Case's action in naming Colonel George Pope alone practically disposes of the matter in Connecticut.

Market Changes of the Week

A most encouraging market report is this week's. Only two drops occurred, Cottonseed oil, $0.23, and U-River Para, $0.01. The other changes were a gain of $0.45 for tin, $0.07 1-2 for raw silk from Japan, $0.02 for linseed oil, and $0.01 for fish oil. Both coppers and the rest of the list remained constant throughout the week. The outlook of the steel industry is more or less cloudy. There must be readjustment to meet the new conditions imposed by the present tariff, which is likely to continue in force for at least several years.

Material	Wed.	Thurs.	Fri.	Sat.	Mon.	Tues.	Week's Change
Antimony, lb.	.06	.06	.06	.06	.06	.06	....
Beams & Channels, 100 lbs.	1.36½	1.36½	1.36½	1.36½	1.36½	1.36½	....
Bessemer Steel, ton	20.00	20.00	20.00	20.00	20.00	20.00	....
Copper, Elec., lb.	.14¼	.14¼	.14¼	.14¼	.14¼	.14¼	....
Copper, Lake, lb.	.14⅝	.14⅝	.14⅝	.14⅝	.14⅝	.14⅝	....
Cottonseed Oil, bbl.	6.92	6.87	6.83	6.81	6.77	6.69	— .23
Cyanide Potash, lb.	.17	.17	.17	.17	.17	.17	....
Fish Oil, Menhaden, Brown	.38	.38	.38	.38	.39	.39	+ .01
Gasoline, Auto, 200 gals.	.22¼	.22¼	.22¼	.22¼	.22¼	.22¼	....
Lard Oil, prime	.92	.92	.92	.92	.92	.92	....
Lead, 100 lbs.	4.00	4.00	4.00	4.00	4.00	4.00	....
Linseed Oil	.50	.52	.52	.52	.52	.52	+ .02
Open-Hearth Steel, ton	20.00	20.00	20.00	20.00	20.00	20.00	....
Petroleum, bbl., Kansas, crude	1.03	1.03	1.03	1.03	1.03	1.03	....
Petroleum, bbl., Pa., crude	2.50	2 50	2.50	2.50	2.50	2.50	....
Rapeseed Oil, refined	.62	.62	.62	.62	.62	.62	....
Rubber, Fine Up-River, Para	.74	.73	.74	.73	.73	.73	— .01
Silk, raw Italy	....	4.95	....	....	4.95	4.95	....
Silk, raw Japan	....	3.90	....	....	3.97½	3.97½	+ .07½
Sulphuric Acid, 60 Baumé	.90	.90	.90	.90	.90	.90	....
Tin, 100 lb.	37.40	37.60	37.40	37.40	37.60	37.85	+ .45
Tire Scrap	.05	.05	.05	.05	.05	.05	....

October Exports Out

Figures Show 1,697 Passenger Vehicles, 79 Commercial Cars—Valued at $1,788,222

WASHINGTON, D. C., Dec. 15—Figures made public today by the bureau of statistics show that 1,697 pleasure cars, valued at $1,658,716, and 79 commercial cars, valued at $129,506, were exported in October last. The exports for the corresponding month of last year were 1,530 pleasure cars, valued at $1,464,934, and 82 commercial cars valued at $118,878. The shipments of cars during the 10 months ended October, 1913, were 21,872 pleasure cars, valued at $21,609,434 and 857 commercial cars, valued at $1,480,646. The combined exports of pleasure and commercial cars for the same period of 1912 was 20,018, valued at $19,836,111.

Exports of parts, not including engines and tires, are growing by leaps and bounds. The exports increased in value from $328,700 in October, 1912, to $728,470 in October last, and from $3,936,110 to $5,177,262 during the 10 months' period.

Shipments of cars, by countries during the periods under consideration, are given at the bottom of the page.

Twenty-nine motor cars, valued at $74,646, were imported in October, as against 78 cars, valued at $170,410, imported in October a year ago. The imports for the 10 months' period declined from 694 cars, valued at $1,573,584, in 1912, to 417 cars, valued at $983,445, in 1913. Imports of parts, except tires, increased in value from $18,528, in October, 1912, to $50,595, in October last, and from $241,262 to $242,031, during the 10 months' period.

The imports of cars, by countries during the periods under consideration, are given at the bottom of the page.

New Rating Saves Car Shippers' Money

NEW YORK CITY, Dec. 15—The official classification committee of the general traffic department, has made a few changes, to take effect January 1, the most important being that on automobiles. To automobile chassis, freight delivery wagons or trucks, warehouse or platform trucks, including automobiles, a rating is added to the less carload items providing that when they are loaded on flat or gondola cars, the charges will be for not less than 5,000 pounds, each at the first class rate. This is the customary charge on all articles which from their bulk or length require a flat car for transportation. On rubber, scrap, including old worn-out tires, the following note is to be added: "In order to be entitled to the rating provided for rubber scrap, shipments of old worn-out rubber tires must be described by the shipper in the bill of lading and the shipping order as Old-Worn-Out Rubber Tires." On pneumatic tires and pneumatic tire repair kits, the present rating does not include these in carload mixture. The new rating states that pneumatic tire repair kits may be shipped with carload quantities of rubber pneumatic tires at the rating applying on such tires, when in the same package or container with the tires, or in the same car with the tires, in carload quantities, provided that not more than one tire repair kit is included for each set of four tires.

The most important change is that on automobiles and open-bodied trucks in mixed carloads. The present rating is subject to the less than carload rating on each machine. The new rating on automobiles, straight or mixed carloads, or in mixed carloads with the open-bodied trucks, axles, chassis, bodies, tops, radiators, engine or gear parts, wheels or wheel rims or channels, is rated as first class material, with a minimum weight of 10,000 pounds. That is to say, in a shipment made from Detroit to New Orleans, consisting of a 4,000-pound touring car and a 5,000-pound truck, the old rating would be $92.80 on the touring car and $116 on the truck, making a total of $208.80. With the new rating, the same shipment, would cost $116, or $1.16 per 1,000 pounds, with a gain of $92.80 on that carload. This would also enable the shipper to ship, free of charge 1,000 more pounds of parts, because he had only 9,000 pounds included in the car and truck.

Owner's Liability Rule Modified in Decision

NEW YORK CITY, Dec. 14—An action was recently brought to recover for personal injuries alleged to have been sustained on March 1, 1913, through the negligence of the defendant's chauffeur in operating an automobile on a public highway. The rule that where a member of an automobile owner's family, or an employee, borrows the automobile and uses it for his own purposes, the owner cannot be held responsible for damages for injuries inflicted, was modified recently, when a decision on the above action was handed down in the Appellate term of the Supreme Court in favor of the plaintiff, Jacob Rainish, the guardian ad litem of Abraham Cohen, a child, against Louis Borgenecht, who ran over and hurt it last March.

It seems that the chauffeur was obeying general orders to use the machine as required by the members of the owner's family.

The Judge in his verdict says: "While the authorities hold that where even a member of the owner's family or an employee borrows an automobile and uses it for his own purpose the owner cannot be held liable, I am of the opinion that said authorities do not apply to the case at bar. Here the evidence is that the machine was in general use for the members of defendant's household; that the chauffeur who operated the machine at the time of the injury to the plaintiff was not only in the employ of the defendant and subject to his control at that time, but was acting in obedience to the general orders of defendant to take the machine at any time to such places as might be required by members of the defendant's family. To hold the defendant not responsible for the acts of his employee under such circumstances would be subversive of law and justice."

The case will have its second trial in January, when it will be determined whether or not the car was negligently operated.

Col. Harvey Wins Suit Fought on Principle

NEW YORK CITY, Dec. 13—Col. George Harvey, recently editor of Harper's Weekly, won a suit yesterday involving $95, which he carried to the Appellate term of the Supreme Court as a matter of principle. The Court held that he was entirely justified in his attitude and laid down an important rule of law involving cases similar to his.

Automobiles and Parts Exported from the United States

	October				Ten Months Ending October					
	1912		1913		1911		1912		1913	
Country	Quantities	Values	Quantities	Values	Quantities	Values	Quantities	Values	Quantities	Values
France	42	$24,820	59	$35,759	366	$413,030	585	$439,313	714	$546,0[illegible]
Germany	45	45,432	32	27,923	95	112,121	392	316,201	890	775,466
Italy	13	9,785	18	19,172	167	192,339	254	224,436	277	241,180
United Kingdom	265	219,578	283	250,293	2,776	2,407,373	4,207	3,163,696	4,183	3,184,530
Other Europe	62	54,103	82	91,421	685	635,378	1,340	1,098,761	1,565	1,355,249
Canada	405	491,133	298	423,016	4,300	4,770,911	6,393	7,704,772	5,558	7,473,333
Mexico	17	30,719	24	41,354	210	351,007	198	320,592	199	362,733
West Indies and Bermuda	35	32,418	35	36,110	236	270,994	273	283,116	405	397,538
South America	191	202,610	182	181,230	766	967,358	1,586	1,817,988	2,271	2,554,210
British Oceania	264	230,665	356	310,163	1,729	1,602,383	2,849	2,586,185	2,774	2,585,389
Asia and other Oceania	186	167,072	231	221,694	645	647,067	1,321	1,310,323	2,001	1,969,777
Other countries	87	75,477	176	150,087	221	238,161	620	570,728	1,892	1,644,585
Total	1,612	$1,583,812	1,776	$1,788,222	12,196	$12,608,127	20,018	$19,836,111	22,729	$23,090,080

Automobiles and Parts Imported by the United States

	October				Ten Months Ending October					
	1912		1913		1911		1912		1913	
Country	Quantities	Values	Quantities	Values	Quantities	Values	Quantities	Values	Quantities	Values
France	51	$105,754	15	$38,961	262	$567,665	384	$914,639	158	$370,272
Germany	1	762	1	3,000	129	280,385	45	105,131	78	205,931
Italy	7	13,324	6	11,455	100	159,188	80	129,551	74	137,373
United Kingdom	8	24,318	5	16,691	127	305,531	115	278,583	42	128,993
Other countries	11	26,252	2	4,539	155	344,512	70	145,680	65	140,876
Total	78	$170,410	29	$74,646	773	$1,657,281	694	$1,573,584	417	$983,445

C. E. Miller, a dealer in automobile supplies, sold Col. Harvey two tires on July 17, 1912, which were paid for and ordered shipped to his home at Allenhurst, N. J. In the shipping of the tires Mr. Miller put no valuation on them. The tires were never delivered. He then ordered two more, and refused to pay for these on the ground that he had paid for the others and they had never been delivered. Mr. Miller sued and got a judgment for the value of the tires.

After an appeal by Col. Harvey, the verdict was set aside yesterday. The Court said: "It is neither reasonable nor just for shippers to deliver goods to a carrier in behalf of their consignees under contracts which fail to indemnify them and destroy their rights of recovery for goods so consigned."

Ford Adopts New Payment Method

DETROIT, MICH., Dec. 16—The Ford Motor Co. has inaugurated a new system of paying for its purchases, which is said to have no exact analogy in modern business. The big motor car company has sent out an announcement to all of the firms from which it purchases materials, parts and supplies stating that hereafter instead of sending out checks for amounts due, it will deposit the money to the credit of these firms in the Highland Park State Bank. It is set forth that these creditors are at liberty to check on these accounts which the Ford company opens for them, drawing out the whole amount or any part of it, but the company "trusts that the account will not be withdrawn," according to the announcement.

This new scheme for the paying of invoices is intended to save much clerical work and time. It also gives the business house of which the Ford company is a customer the opportunity to make use of the money just as soon as the account becomes due. The Ford company probably disburses about $6,000,000 monthly by check for current accounts, and the saving in labor is therefore apparent.

The Highland Park State Bank has no direct connection with the Ford Company, although Henry Ford is a large stockholder in it, while James Couzens, treasurer and vice-president of the Ford company is head of the bank. It is located in Highland Park, a suburb of Detroit, and close to the Ford plant. It was organized in 1909 to handle the Ford company's financial business, but its business is by no means confined to this company alone. Its resources are over $3,000,000 and it carries deposits of $2,700,000.

Merchant & Evans To Market Tractor

PHILADELPHIA, PA.—The Merchant & Evans Co., of this city is preparing to market the Devon two-wheel tractor. This is a front-drive, chain-driven machine in which the power plant is mounted directly on the front axle which swings on a king-bolt. It is a 4- to 5-ton machine and sells for $2,750 in chassis and $3,000 with steel body.

Orson Assets $42,038

NEW YORK CITY, Dec. 15—More than 2 years ago the Orson Auto Co., of Springfield, Mass., exhibited the first of its automobiles at a prominent hotel reception, and since then has been heard from no more. This company, it will be remembered, was formed by a number of New York millionaires to manufacture their own cars in accordance with exclusive ideas and intending to limit production to exactly 100 cars, the number of subscribers. The first public appearance of the company since is contained in a statement submitted by the Secretary of State of Massachusetts last week. The statement covers the period ending October 31, and gives the company finances as follows: Equipment, $450; cash and debts receivable, $34,917; merchandise, $6,671; total assets, $42,038; capital, $15,000; accounts payable, $11,793; profit and loss, $15,245; total liabilities, $42,038.

NEW YORK CITY, Dec. 17—The Motor Truck Club of this city held a meeting tonight at the Hotel Cumberland, where it took the final formal steps to become incorporated as a national organization. The incorporation papers of the Motor Truck Club of America, Inc., the name which the club will employ in the future, have been filed with the Secretary of State at Albany. This club now has 257 members.

NEW YORK CITY, Dec. 15—A petition in bankruptcy has been filed against the Aristos Co., dealer in automobile accessories at 250 West Fifty-fourth Street, by these creditors: Charles Pine, $245; E. W. Lyons, $200, and J. T. Parkes, $103, all on notes. It was alleged that while insolvent the company since September 2 made preferential payments to six creditors aggregating $6,585. The company is a Delaware corporation, with a capital stock of $400,000. C. D. Knapp was President and Henry C. de Rham Treasurer.

Ford Has Big Year

Company Has Surplus of $28,124,173.68 —$13,225,710.82 in Cash— Complete Statement

DETROIT, MICH., Dec. 15—The balance sheet of the Ford Motor Co. as of Sept. 30, 1913 has just been made public and shows a surplus of $28,124,173.68. The assets are shown to total $35,033,919.86, of which $13,225,710.82 is in cash. The merchandise inventories $9,046,171.68, while buildings and building fixtures amount to $4,615,156.82 and machinery $2,305,-962.09. Patents owned by the Ford company represent a total value of $57,224.27.

The company has outstanding current accounts of only about $3,000,000 and its entire liability exclusive of the surplus amounts to about $7,000,000. Thus the surplus would cover this four times over. The Ford company's capital stock is $2,000,000.

The complete statement, as issued by James Couzens, treasurer, follows:

ASSETS

Cash on hand and in banks	$13,225,710.82
Michigan municipal tax exempt bonds at cost	1,283,943.59
Accounts receivable	448,233.93
Merchandise inventory at cost	9,046,171.68
Other investments	7,433.32
Prepaid expenses	215,259.29
Real estate	1,540,483.42
Buildings and building fixtures	4,615,156.82
Factory equipment	676,589.49
Office furniture and fixtures	77,357.60
Power plant	526,945.24
Machinery	2,305,962.09
Tools	824,901.04
Patterns	92,710.13
Machinery, tools and equipment at branches	89,837.13
Patents	57,224.27
	$35,033,919.86

LIABILITIES

Accounts payable	$3,049,586.86
Accrued payrolls	191,940.70
Accrued salaries	24,169.30
Accrued expenses	266,119.43
Contract rebates	25,960.00
Reserve for employees' bonus	134,999.96
Reserve for bad debts	3,510.55
Reserve for depreciation of fixed assets	1,061,805.25
Reserve for depreciation of patents	57,224.63
Reserve for fire insurance premiums	34,059.63
Reserve for unearned profits (branches)	60,370.23
Capital stock	2,000,000.00
Surplus	28,124,173.68
	$35,033,919.86

Weed Co. Now Owns Lyon Grips

NEW YORK CITY, Dec. 16—The Weed Chain Tire Grip Co. now owns and controls the Lyon grips for solid tires. They are expressly designed to meet the peculiar requirements of the solid tires used on motor trucks. The design of Lyon grips is such that when mounted on the wheel each grip is virtually a unit, with only the needed elasticity in its own members to enable it to yield slightly with the tire as the latter compresses on rolling over the tread portions.

Stewart to Make Seek Regulator

CHICAGO, ILL., Dec. 16—The Stewart Warner Corp. has taken over the patents of the Seek Regulator, a device which automatically varies the proportions of air and fuel in a carbureter with variations in temperature of the motor. Thus, a motor when cold needs a richer mixture than when it is warmed up and the Seek regulator is intended to maintain the proportions required for most efficient running. This device is the invention of J. H. Seek and has been described in these columns under the name of the Seekostat. It is expected that the Stewart-Warner Corp. will manufacture these in quantities for installation to new cars and those already in service.

TRENTON, N. J., Dec. 12—Certificates of dissolution of the Empire Tire Co. and the Empire Rubber Co. were filed here with the Secretary of State. The dissolution, stockholders of the company declare, is necessary by reason of the formation of the Empire Tire & Rubber Co.

ADDING to Lee Factory Equipment—The Lee Tire & Rubber Co., Conshohocken, Pa., reports that the sale of its tires has quadrupled during the last 9 months and an increase in the other departments of the business of more than 50 per cent. A new 600 horsepower addition to the boiler house is to be completed and a new calender and several 60-inch mills are on the ground ready for erection. Three new tire making machines and several hundred cores and side rings for the manufacture of pneumatic automobile tires are in transit; the total new equipment, involving an expenditure of between $50,000 and $75,000. These additions will take care of an output of between 800 and 1,000 tires daily and permit a further increase in business during 1914 equal to that accomplished in 1913.

Detroit Seamless Tube Building—The Detroit Seamless Steel Tubes Co., Detroit, Mich., is building a tube rolling mill.

Ravenna Will Build—The Ravenna Motor Truck Co., Ravenna, O., will soon select an architect to prepare plans for a cement block factory addition, 50 by 100 feet. The work will mature in the spring.

Bridgeport Co. Will Build—The Bridgeport Auto Co., formed recently, is having plans and specifications prepared for a large plant to be erected at Bridgeport, O., for the making of automobiles. It is said an eastern concern will be merged with the Bridgeport company in the near future.

Increasing Jeffery Plant—Another big addition to the Jeffery works at Kenosha, Wis., which now covers 25 acres wtih 105 acres in which to expand, is about to be made. This building will contain approximately 2.25 acres of floor space, and will be of standard saw tooth construction. A force of 200 men is working on this structure.

Ford Buys Louisville Land—The Ford Motor Co. has bought from the Ohio River Sand Co. a plot of ground on the Southern and Louisville & Nashville tracks at Third street, Louisville, Ky., and will begin immediately the construction of an assembling plant at a cost of approximately $200,000. The plant will employ between 200 and 300 men and will be used to supply the trade in this section.

Safety at Goodyear Factory—One hundred and fifteen factory foremen of the Goodyear Tire & Rubber Co., Akron, O., have been organized into a safety first battalion. Moving pictures showing safety devices and the danger of their absence, illustrated various talks, and a squad was organized to patrol the 41-acre factory constantly, looking for dangerous operations, instructing workmen and suggesting safety devices.

Meteor's New Plant—The Meteor Motor Car Company of Shelbyville, Ind., has taken over the plant of the Sprague-Smith Furniture Co., in that city, and will remodel it in a factory for the manufacture of motor cars. The Indiana charter of the corporation will be surrendered and a charter under Ohio laws will be taken out. The authorized capital will be $50,000. Maurice Wolfe of Piqua is head of the company. It is planned to make ten to fourteen cars per day.

Flyer Plant at Mt. Clemens—The recently organized Flyer M. C. Co., Detroit, Mich., which is to manufacture the Flyer car, designed by Al Gloetzner, has secured a factory at Mt. Clemens, and will occupy a plant temporarily in that city until the new plant has been completed. The output of the company will be marketed by the Thomas Howard Co., Brooklyn, N. Y., and 2,500 cars will be made.

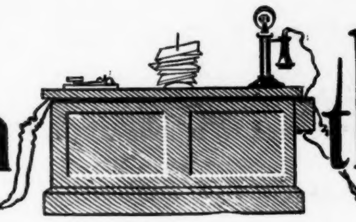
Tops Made for Cyclecars—A new industry, the manufacture of tops and wind shields for cyclecars, has been established at Manitowoc, Wis., by Joseph Steiner, inventor of a simple top and glass front for the new type of vehicle.

Parts Factory Near Rochester—The Hansel Mfg. Co., Inc., Rochester, N. Y., has been incorporated with a capital stock of $25,000 to manufacture automobile parts. It is probable the company's plant will be located in East Rochester, N. Y. W. H. Cole, W. E. and B. B. Hansel are the incorporators.

The Automobile Calendar—Shows, Meetings, Etc.

Dec. 11-20	New York City, First International Exposition of Safety and Sanitation, under the auspices of the American Museum of Safety.
Dec. 17-20	Davenport, Ia., Annual Show, Armory Hall, Tri-City Auto Dealers' Assn.
Jan. 2-10	New York City, Importers' Automobile Show, Hotel Astor.
Jan. 3-10	New York City, Automobile Show, Grand Central Palace.
Jan. 4-8	New York City, Meeting S. A. E.
Jan. 5-10	Los Angeles, Cal., Automobile Show, Grand Avenue Pavilion.
Jan. 10-16	Milwaukee, Wis., Sixth Annual Show, Auditorium, Milwaukee Automobile Dealers' Assn.
Jan. 10-17	Cleveland, O., Automobile Show, Wigmore Coliseum, Cleveland Automobile Show Co.
Jan. 10-17	Philadelphia, Pa., Show Metropolitan Building, Automobile Trade Assn., H. W. Terry, Secretary.
Jan. 10-21	Brussels, Belgium, Salon de l'Automobile du Cycle et des Sports; Chambre Syndicale de l'Automobile et du Cycle de Belgique.
Jan. 12-17	Bridgeport, Conn., Annual Automobile Show, State Armory, B. B. Steiber, manager.
Jan. 17-24	Pittsburgh, Pa., Annual Automobile Show, Automobile Dealers' Assn.
Jan. 19-24	Washington, D. C., Automobile Show, Convention Hall, Washington Automobile Dealers' Assn.
Jan. 24-31	Montreal, Que., Automobile Show, Passenger Cars, Montreal Automobile Trade Assn.
Jan. 24-31	Rochester, N. Y., Automobile Show, Exposition Park, Rochester Automobile Dealers' Assn.
Jan. 24-31	Chicago, Ill., Automobile Show, Coliseum and First Regiment Armory.
Jan. 26-31, 1914	Scranton, Pa., Automobile Show, Automobile Assn. of Scranton.
Jan. 31-Feb. 7	Minneapolis, Minn., Automobile Show.
Feb.	Hartford, Conn., Show.
Feb.	St. Louis, Mo., Show.
Feb. 2-7	Buffalo, N. Y., Automobile Show, Buffalo Automobile Dealers' Assn.
Feb. 3-7	Kalamazoo, Mich., Show.
Feb. 3-7	Montreal, Que., Motor Truck Show, Montreal Automobile Trade Assn.
Feb. 4-7	St. Joseph, Mo., Annual Show, St. Joseph Auditorium, St. Joseph Automobile Show Assn.
Feb. 7-12	Seattle, Wash., Annual Automobile Show, State Armory Bldg., W. I. Fitzgerald, Manager.
Feb. 9-14	Buffalo, N. Y., Truck Show, Buffalo Automobile Dealers' Assn.
Feb. 9-14	Buffalo, N. Y., Commercial Car Show, Buffalo Automobile Dealers' Assn.
Feb. 9-14	Grand Rapids, Mich., Fifth Annual Western Michigan Show, Klingman Furniture Exposition Bldg., *Grand Rapids Herald.*
Feb. 14-21	Pittsburgh, Pa., Automobile Show, Pittsburgh Auto Show Assn.
Feb. 16-21	Kansas City, Mo., Auto Show.
Feb. 18-21	Bloomington, Ill., Automobile Show, McLean County Automobile Club.
Feb. 21-28	Newark, N. J., Automobile Show, N. J. Auto Trade Assn.
Feb. 21-28	Cincinnati, O., Automobile Show, Cincinnati Automobile Dealers' Assn.
Feb. 23-28	Omaha, Neb., Automobile Show, Omaha Automobile Assn.
Feb. 24-28	Syracuse, N. Y., Automobile Show, State Armory, Syracuse Automobile Dealers' Assn.
Mar. 2-4	Cincinnati, O., Commercial Vehicle Show, Cincinnati Automobile Dealers' Assn.
Mar. 2-6	Fort Dodge, Ia., Show, Fort Dodge Auto Dealers' Assn.
Mar. 7-14	Boston, Mass., Automobile Show.
Mar. 9-14	Des Moines, Ia., Show, Des Moines Automobile Dealers' Assn.
Mar. 17-21	Boston, Mass., Truck Show.
Apr. 9-15	Manchester, N. H., Automobile Show.
May 30	Indianapolis, Ind., 500-mile Race, Indianapolis Motor Speedway.

The Week in the Industry



Motor Men in New Roles

MARSHALL Moline Chief Inspector—The Moline Automobile Co., East Moline, Ill., has secured A. F. Marshall, of Coventry, England, as chief inspector.

Hood Dies at Hamilton—G. H. Hood, veteran rubber manufacturer of New England, died at Hamilton, Mass., last week at the age of 78.

Hawley Leaves Krit—Phil Hawley has resigned his position with the Krit M. C. Co., Detroit, Mich. He was Eastern sales representative.

Froelich Shot by Robbers—Morris Froelich, president of the Chicago branch of the Times Square Automobile Co., was shot and badly wounded by robbers recently.

Kirk Leaves Badger Brass—Ezra E. Kirk, who has been the general traveling representative of the Badger Brass Mfg. Co., Kenosha, Wis., has discontinued in that capacity.

Bray Atterbury Service Engineer—J. B. Bray has joined the Atterbury M. C. Co., in Buffalo, N. Y., as service engineer. He was formerly with the Continental Motor Co.

Hoosier President Off for Orient—P. C. Rubush, president of the Hoosier Motor Club, Indianapolis, Ind., has left the Hoosier capital for a trip to the Philippine Islands, Japan and China.

Randall Joins Taylor-Critchfield—F. M. Randall has resigned as vice-president of the H. K. McCann Co. to become associated with the Taylor-Critchfield Co., Chicago, Ill. His headquarters will be in Detroit, Mich.

Thatcher Memphis Firestone Manager—F. W. Thatcher, who was formerly with the Detroit, Mich., branch of the Firestone Tire & Rubber Co., has been appointed manager of the Memphis, Tenn., branch of the company.

Kinsman Dies—B. T. Kinsman, manager of the Chicago Studebaker branch and formerly connected in a similar capacity with the Studebaker branches at Boston and Buffalo, died suddenly in Buffalo from acute indigestion.

Dunham Back in Boston—G. J. Dunham, formerly president of the Royal Tourist Co. and a former Boston agent for that car, is again in that city, having been made manager of the J. H. MacAlman M. C. Co., agent for the Stearns.

Willower Gramm Assistant Manager—H. B. Willower has gone to Tacoma, Wash., as assistant sales manager of the Northwest branch of the Gramm-Bernstein Co., Lima, O. He will later have entire charge of the Seattle branch office.

Leave Abbott—A. E. Schaefer and L. B. Sanders, president and sales manager, respectively, of the Abbott Motor Co., have resigned from that company. A number of traveling and sales representatives of the concern have also severed their relations with it.

Jenatzy Killed in Accident—Camille Jenatzy was shot recently in the Belgium Ardennes by Alfred Mardoux, editor of the journal L'Etoile Belge. They were both members of a hunting party, and the shooting was accidental.

Grant Goes Abroad—Harry Grant has gone to Europe with a commission from Paul Zeigler to purchase the fastest automobile he can find on the other side, and he will visit the Brooklands to note the speed of the Sunbeam and some of the other machines that have been making records there.

Matheson P.-S. Sales Manager—C. W. Matheson, formerly western manager for the Palmer & Singer Mfg. Co., has become general sales and advertising manager and will make his headquarters at the factory in Long Island City, N. Y. S. P. Woodward, who formerly handled the sales as well as acting as secretary, will devote his whole time to his secretarial duties.

Garage and Dealers' Field

International Motors Moves—The International Motors Co. has removed to the southwest corner of 23d and Chestnut streets, Philadelphia, Pa.

Philadelphia Peerless Moves—The Peerless Motor Co. has removed to the new sales and service building at 2314 Chestnut street, Philadelphia, Pa.

Stewart-Warner's Factory Branch—A factory branch of the Stewart-Warner Speedometer Corp. has been reopened in Kansas City, Mo., with Joseph Suess as manager.

Knight Factory Branch Opened—A direct factory branch of the Knight Tire & Rubber Co., Kansas City, Mo., has been opened at 1528 Grand avenue in charge of E. J. Berry.

Stearns Moves in Philadelphia—The F. B. Stearns Co. has removed from the southeast corner of Broad and Hamilton streets, Philadelphia, Pa., to a more central location at 245 North Broad street.

Goodyear to Handle U. S. Gauge—Arrangements have been made by the Goodyear Tire & Rubber Co., Akron, O., to sell its customers tire pressure gauges. These gauges are the product of the U. S. Gauge Co., New York City.

Gray Starter's Milwaukee Office.—R. D. Mitchell, Milwaukee (Wis.) distributor of the Gray pneumatic gear-shift and engine starter, has established general offices at 406 Free Press Building and a service and installation station at 138 Sixth street.

Diamond-Goodrich Frisco Combine—The San Francisco, Cal., branches of the Diamond Rubber Co. and the B. F. Goodrich Co. have been consolidated and will move into the building at Fremont and Mission streets, formerly occupied by the Studebaker Corp. Messrs. Miller, Cook and Mathewson remain in charge.

Riess Acquires All American Parts—C. E. Riess & Co., Inc., of Broadway and 53d street, New York City, eastern representatives of the Hupmobile, recently acquired at auction all parts for the American and Marion cars, and will hereafter supply all needs and service for these cars at their service station, 250 West 14th street.

Corbin Screw Opens New Stations—The Corbin Screw Division of the Corbin Brown Speedometer Co., New Britain, Conn., has opened stations in the following cities: Milwaukee, Rochester, Grand Rapids, Indianapolis, St. Louis, Toledo, Cincinnati, Dallas, San Antonio, Baltimore, Birmingham, Columbus, Duluth, Kansas City, Washington, Louisville, Pittsburgh, Syracuse and Omaha.

Richmond Forgings' Detroit Office—The Richmond Forgings Corp., Richmond, Va., has opened a permanent office at Detroit, Mich., which will be under the sales manager, L. C. Wellford. Offices have been taken in the Dime Bank Building. This company has also arranged with A. O. Knudson, Newton Centre, a suburb of Boston, Mass., to look after its large New England trade. Extensive additions have been made to its equipment in anticipation of heavy Spring business.

Large Schlitz Brewing Garage—The Jos. Schlitz Brewing Co., Milwaukee, Wis., which has been a large user of motor trucks for several years, and now intends to replace every bit of its horse-drawn equipment with motor-propelled vehicles, is having plans drawn for a structure that will be the largest private garage in the Middle West. The building will be 200 by 150 feet in size, two stories high, fireproof construction, and cost $50,000 with equipment, including a complete repair shop. It will be located at Fourth and Galena streets, and form part of the immense group of buildings comprising the Schlitz Brewery.

Three Rubber Concerns for Milwaukee—As a direct result of the Goodyear fire, which on October 26 caused a total loss of $600,000 to several concerns, including the Goodyear Rubber Co., 384-386 East Water street, Milwaukee, Wis., is to have three large rubber companies, which will also act as tire distributors. The Goodyear company is now in temporary quarters on East Water street, one block south of the former site, and contracts are about to be awarded for the construction of a six or eight-story building on the old site. Victor M. Stamm, who was manager of the tire department of the Goodyear company, State distributor for the G. & J. brand of U. S. tires, has resigned and will be manager of the new Milwaukee branch to be established by the Hub-Mark Rubber Co., of Boston. Harold D. Detienne, for several years with the Goodyear company's Milwaukee house, has also resigned to establish the Wisconsin Rubber Co. in Milwaukee. James Suydam, district manager of the Goodyear company, with headquarters in St. Paul, is in charge of the Milwaukee store at present.

Recent Incorporations in the Automobile Field

AUTOMOBILES AND PARTS

ALBANY, N. Y.—Mack Motor Truck Co.; capital, $10,000; to deal in motor trucks. A. J. Cook, M. C. Fitzgerald, W. A. Hamilton.

BOSTON, MASS.—Stutz M. C. Co.; capital, $90,000; to deal in automobiles. Incorporators: M. P. Chase, M. F. Chase, G. E. Kimball.

BROOKLYN, N. Y.—Empire Postal Motor Co.; capital, $10,000; to deal in automobiles. Incorporators: C. J. Gillen, R. W. Kathan, A. M. Kathan.

BUFFALO, N. Y.—Meyer Motor Co.; capital $50,000; to deal in automobiles. Incorporators: A. W. and C. H. Meyer, F. D. L. Stowe.

BUFFALO, N. Y.—Hurd-Landsheft Motor Co.: capital, $7,500; to deal in automobiles. Incorporators: M. J. Hurd, C. M. Hugo, R. Landsheft.

CHICAGO, ILL.—Chicago Grant Motor Sales Co.; capital, $5,000; to manufacture and deal in automobile parts, accessories, etc. Incorporators: E. H. Abbott, E. W. Fassett, C. C. Mowbray.

CHICAGO, ILL.—Triple Action Spring Co.; capital, $25,000; to manufacture and deal in springs, mechanical appliances, automobiles, accessories, etc. Incorporators: O. G. Temme, R. H. Mather, C. R. Church.

CLEVELAND, O.—Dunham Motor Co.; capital, $10,000; to buy and sell and deal in automobiles. Incorporators: C. W. Rush, G. K. Wadsworth, H. A. Mullen, L. A. Dunham, T. S. Dunlap.

COLUMBUS, O.—Guaranty Service Truck Co.; capital, $12,000; to sell and deal in and repair automobiles and to carry on a taxicab business. Incorporators: W. H. Klunm, W. C. Brewer, G. F. McDowell, J. M. Borst, R. A. Nichols.

COLUMBUS, O.—Direct Drive Axle Co.; capital, $10,000 to bny, sell, lease and manufacture all kinds of axle transmission. Incorporators: W. E. Campbell, C. O. Haines, C. T. Phillips, L. H. Pleukharp, H. B. Gilchrist.

EVERETT, WASH.—Coast Four Wheel Auto Co.; capital, $10,000; to deal in automobiles. Incorporators: E. J. and M. A. Kennedy, L. and C. Frazier.

HACKENSACK, N. J.—Feakes Garage Co.; capital, $25,000; to deal in automobiles. Incorporators: H. E. Feakes, L. N. Blair.

HARTFORD, CONN.—Buick Taxicab Co.; capital, $10,000; to carry on a general taxicab business. Incorporators: A. C. Bieber, F. M. Bieber, David Roberts.

HOUSTON, TEX.—Spring-Roberts Auto Co.; capital, $15,000; to deal in automobiles. Incorporators: W. H. Spring, F. S. Roberts, L. D. Thomas.

INDIANAPOLIS, IND.—Briskin-Wolsiefer Mfg. Co.; capital, $10,000; to manufacture automobile parts. Incorporators: J. H. Briskin, C. C. Wolsiefer, H. W. Bullock.

LANSING, MICH.—Parrett-Barbour Motor Sales Co.; capital, $10,000; to deal in automobiles. Incorporators; W. L. Parrett, H. J. Latour.

NASHVILLE, TENN.—Woods Electric Vehicle Co.; capital, $3,000; to deal in automobiles. Incorporators: H. Dodd, W. D. Frost, F. C. Dodd and others.

NEWARK, N. J.—Essex Motors Mfg. Co.; capital, $100,000; to manufacture motors, machinery, supplies, etc. Incorporators: W. H. Simpson, N. E. Hudden, J. J. Coyle.

PHILADELPHIA, PA.—Fiat Motor Co.; capital, $40,000; to deal in automobiles.

TOLEDO, O.—Silent American Motor Co.; capital, $10,000; to manufacture and deal in all kinds of gasoline motors. Incorporators: S. F. Sawyer, J. R. Ford, W. G. Kirkbridge, H. C. Crane, E. H. Reed.

WICHITA, KAN.—Jackson Motor Co.; capital, $3,333; to deal in automobiles. Incorporators: W. H. Hiskey and others.

WILMINGTON, DEL.—Utility Motors Corp.; capital, $100,0000; to deal in automobiles. Incorporators: W. J. Maloney, H. E. Latter, O. J. Reichard.

WILMINGTON, DEL.—Auto-Coach Co.; capital, $300,000; to manufacture and sell automobiles, cabs, etc. Incorporators: H. E. Latter, W. J. Maloney, O. J. Reichard.

GARAGES AND ACCESSORIES

BROOKLYN, N. Y.—Interstate Accessories Corp.; capital, $10,000; to deal in automobile accessories. Incorporators: Leon Kauffman, S. M. Kohn, Albert Strauss.

CHICAGO, ILL.—Chicago-St. Louis Automobile Boulevard; capital, $6,000; to build an automobile boulevard. Incorporators: N. T. Allen, Fred Peterson, R. D. Moore.

CHICAGO, ILL.—Chicago Motor Bus Co.; capital, $10,000; motor bus service. Incorporators: D. J. Schuyler, S. A. Ettelson, C. W. Einfeld.

CHICAGO, ILL.—Motor Devices Co.; capital, $3,000; to manufacture and sell automobile accessories. Incorporators: G. M. Shontz, G. A. Kelly, R. D. Donavan.

CINCINNATI, O.—Warner Auto Top Co.; capital, $40,000; to manufacture automobile tops. Incorporators: W. W. Warner, W. W. Dill, F. A. Brown, K. L. Warner, N. G. Dill.

CLEVELAND, O.—Lea Oil Co.; capital, $15,000; to manufacture and deal in automobile oils and oils of all kinds. Incorporators: F. E. Stuyvesant, H. B. Stuyvesant, A. B. Lea, S. G. B. Lea, H. E. Parsons.

CLEVELAND, O.—Lincoln Motor Van Co.; capital, $1,000; general automobile van business. Incorporators: L. A. Enjawski and others.

ELMHURST, N. Y.—Lemmey Garage, Inc.; capital, $2,000; general garage business. Incorporators: E. A. Dietze, J. J. Pheelan, C. A. Burr.

LANSING, MICH.—Lansing Rubber Co.; capital, $75,000; to manufacture and deal in automobile tires. Incorporators: W. M. Shepherd, A. C. Haite, Frank Preuss.

LANSING, MICH.—Rogers Garage & Repair Co.; capital, $1,000; general garage business. Incorporators: P. L. Fronde, C. H. Amrhein, George Soneer.

LEXINGTON, KY.—Ten Broeck Tire & Rubber Co.; capital, $5,000; to deal in automobile tires. Incorporators: F. L. Koontz, H. L. Lewman, W. M. Cox.

MACON, GA.—Liebson Self-Starter Co.; capital, $50,000; to manufacture self-starters for automobiles. Incorporators: T. N. Baker, J. S. Schofield, W. S. Anderson.

MCKEESPORT, PA.—U. S. Wire Wheel Co.; capital, $100,000; to manufacture wire wheels for automobiles. Incorporators: G. Baehr, S. Kalkstone, T. Lewis.

MILWAUKEE, WIS.—Automobile Roll Top Co.; capital, $50,000; to manufacture and market a top for motor cars. Incorporators: G. W. Browne, A. A. Jonas, P. C. Avery.

NEWARK, N. J.—Mechanical Auto Tube Co.; capital, $100,000; to manufacture inner tubes, tires, etc. Incorporators: B. F. C. Rothwell, W. B. Estes, F. F. Estes.

NEW YORK CITY—Packard Acme Garage; capital, $5,000; general garage business. Incorporators: E. Beugnet, G. Posner, S. S. Levine.

NEW YORK CITY—William Wiese & Co.; capital, $25,000; upholstery for automobiles. Incorporators: William Wiese, Albert Maertens, Chester Wiese.

NEW YORK CITY—M. J. L. Rear Adjustable Bumper, Inc.; capital, $1,000; to deal in bumpers for automobiles. Incorporators: M. J. Leclerc, S. Solinsky, H. Stern.

NORFOLK, VA.—Central Garage; capital, $15,000; general garage business. Incorporators: J. L. Gay, O. H. Gay.

OSSINING, N. Y.—Highgrade Body-Building Co.; capital, $5,000; to build automobile bodies, etc. Incorporators: J. B. Tillottson, J. A. Cuff, R. W. Yates.

RICHMOND, VA.—Liberty Machine and Motor Co.; capital, $25,000; general machine works business. Incorporators: C. R. Curtis and others.

SOUTH BEND, IND.—Coliseum Garage & Machine Co.; capital, $10,000; general garage business. Incorporators: John Walz, W. P. Furey, J. E. Peak.

CHANGES OF NAME AND CAPITAL

CHICAGO, ILL.—Adix Automobile Co.; change of name to the City Automobile Co.

CLEVELAND, O.—Parish & Bingham Co.; capital increased from $244,000 to $1,000,000.

COLUMBUS, O.—Potts-Rine Supply Co.; name changed to the Potts-Seider Supply Co.

EAST PALESTINE, O.—East Palestine Rubber Co.; capital increased from $50,000 to $150,000.

KANSAS CITY, MO.—Jackson M. C. Co.; capital increased from $10,000 to $15,000.

MILWAUKEE, WIS—Feilbach Motor Co.; capital increased from $50,000 to $100,000.

PHILADELPHIA, PA.—Vulcan Motor Device Co.; capital increased from $640,000 to $680,000.

New Agencies Established During the Week

PASSENGER VEHICLES

Place	Car	Agent
Abercrombie, N. D.	Maxwell	J. P. Johnson.
Albany, N. Y.	Kisselkar	Park Garage Co.
Alcaster, S. D.	Maxwell	Henry Ring.
Alma, Mich.	Maxwell	J. W. Wright Co.
Altoona, Pa.	Maxwell	H. L. Stultz.
Athens, O.	Maxwell	J. L. Ravenscroft.
Atlantic City, N. J.	Kisselkar	Victor Garage.
Augusta, Ga.	Maxwell	Walker & Ivey.
Bakersfield, Cal.	Oakland	Bakersfield Garage & Sup. Co.
Bamberg, S. C.	Maxwell	D. Fowling.
Bangor, Me.	Maxwell	S. L. Crosby Co.
Barre, Vt.	Maxwell	H. F. Cutler.
Barron, Wis.	Maxwell	P. O. Solie & Sons.
Belleville, Ill.	Chandler	Aug. Wangelin.
Belleville, Ill.	Overland	Aug. Wangelin.
Bellevue, Mich.	Maxwell	C. H. Legge.
Binghamton, N. Y.	Maxwell	F. W. Van Antwerp.
Boston, Mass.	Century	Century Electric Co.
Cameron, Wis.	Maxwell	Northern Motor Sales Co.
Cape Town, So. Africa.	Jeffery	A. E. Flavell.
Carrollton, Ill.	Maxwell	Casey & Fishback.
Center, Tex.	Maxwell	B. C. Armstrong.
Centerville, S. D.	Maxwell	Nels Lind.
Centralia, Ill.	Reo	Reomer Motor Co.
Charlotte, Mich.	Maxwell	Donovan & McCormick.
Chillicothe, Mo.	Locomobile	B. F. Brogles.
Clifton, Tex.	Maxwell	T. C. Grimland.
College Corner, O.	Maxwell	Chas. Kirkpatrick.
Columbia, Mo.	Locomobile	W. C. Pearman.
Columbus, O.	Haynes	P. H. Rogers.
Colton, Cal.	Oakland	Fred O. Lewis.
Commerce, Tex.	Maxwell	P. W. Maloney.
Constantine, Mich.	Maxwell	E. T. Sevison.
Copac, Mich.	Maxwell	H. C. Siebel.
Cortland, N. Y.	Kisselkar	T. E. Dye & Son.
De Land, Fla.	Maxwell	Gordon Garage Co.
Delano, Minn.	Maxwell	P. W. Bergman.
Doublin, Ga.	Maxwell	J. B. Burch & B. A. Hooks.
Edwardsville, Ill.	Palmer	Tuxhorn Bros.
Elberton, Ga.	Maxwell	Bond & Maxwell.
Ellsworth, Wis.	Maxwell	Al. H. Struve.
Emery, S. D.	Maxwell	H. M. Bleeker.
Evans City, Pa.	Maxwell	Wahl M. C. Co.
Everett, Pa.	Maxwell	A. M. Karns & Son.
Fargo, N. D.	Maxwell	More Bros.
Flint, Mich.	Maxwell	Fowler Garage.
Foley, Minn.	Maxwell	Verner Bros.
Franklin, Mich.	Maxwell	Dr. F. D. German.
Fredericks, Del.	Maxwell	W. W. & S. L. Wilson.
Georgetown, Tex.	Franklin	T. J. Caswell.
Grand Island, Neb.	Maxwell	Matt Jarvis Auto Co.
Grand Rapids, Mich.	Maxwell	Robt. Willey Auto Co.
Granite City, Ill.	Henderson	L. Kaltenbach.
Green Bay, Wis.	Maxwell	L. E. Conley.
Gulfport, Miss.	Maxwell	Horton W. Jones.
Harbor Beach, Mich.	Maxwell	Dell McMann.
Henry, Ill.	Maxwell	Phillips & Lucas.
High Point, N. C.	Maxwell	Central Auto Co.
Hillsboro, Wis.	Maxwell	James Holak.
Hinesville, Ga.	Maxwell	J. B. Way & Son.
Howard City, Mich.	Maxwell	A. B. Potts.
Hugo, Okla.	Maxwell	C. A. Thompson.
Huntington, West Va.	Maxwell	Stevenson & Taylor.
Hutchinson, Kan.	Franklin	Franklin Motor Car Co.
Ironton, O.	Maxwell	F. A. Marting.
Jasper, Ind.	Maxwell	Roettger & Sendelweck.
Jasper, Minn.	Maxwell	Jasper Auto Co.
Kearney, Neb.	Maxwell	Wort & Minton.
Kenyon, Minn.	Maxwell	F. G. Held.
Langdon, N. D.	Maxwell	McLauchlin & Stranger.
Lansing, Mich.	Maxwell	Wolverine Auto Co.
Laurium, Mich.	Maxwell	S. F. Dupont.
Lebanon, O.	Maxwell	John Law & Son.
Lewiston, N. J.	Maxwell	Lewis Yerkes.
Lincoln, Neb.	Oakland	H. E. Stockdale.
Lisbon, N. D.	Maxwell	J. C. Hyde.

A Test of Gear Steel

Armleder Experiments with Chrome-Vanadium

CINCINNATI, O.—Editor THE AUTOMOBILE:—Some years ago we inaugurated an exhaustive series of experiments and service tests to determine the material that would best meet the requirements for gears. A variety of types of steel were investigated. In the final tests in each case loaded trucks were driven 175 miles per day for a period of 30 consecutive days. These were followed by a series of 150-mile non-stop cross country runs under load. In all, the investigation covered a period of 2 years.

As a result, chrome-vanadium steel was selected as the material best adapted to meet the requirements, and has since been used in all Armleder trucks.

In the 3 or 4 years since it was adopted the service results have amply confirmed the conclusion derived from the tests. During this time not a single vanadium transmission gear has been replaced.

Formerly constant trouble was experienced from excessive wear of the gears. Often gears would have to be replaced after only a few months' service. The builder's experience showed invariably that all the ordinary grades of steel would show 50 per cent. deterioration at the end of a year's service.

Since using it for transmission gears the Armleder company has also adopted chrome-vanadium steel for the steering gears for all track models and for the differential gear of its 2000-pound motor wagon.

The type of chrome-vanadium steel used is what is known in the American Vanadium Co.'s classification as Type A and is purchased to the following specifications as to chemical analysis:

Ingredient	Per Cent.	Ingredient	Per Cent.
Carbon	0.20 to 0.30	Silicon	0.20
Manganese	0.70	Sulphur	not over 0.04
Chromium	0.90	Phosphorus	not over 0.04
Vanadium	0.20		

Scleroscope tests of the case-hardened gears show a hardness of 82 on the case and 45 on the core.

The Armleder transmission is of the selective type and cammed on a three-point suspension and flange-bolted to the jack shaft. The gears are five pitch. Four integral milled ground keyways are used on the sliding shaft. The high gear and shaft are made integral and are mounted on three bearings. All bearings are annular and of the S. K. F. type.

The heat-treatment recommended by the American Vanadium Co. for Type A chrome-vanadium steel, case-hardened gears is a double one. After carbonizing they should be reheated to 1650 degree to 1700 degrees Fahrenheit and quenched in oil, then reheated to from 1475 to 1525 degrees Fahrenheit and quenched in water and finally heated to about 350 to 400 degrees Fahrenheit in oil for about an hour to release the strains.

Heat-treated in the above manner, the core of case-hardened chrome-vanadium steel gears will show approximately the following physical properties:

Elastic limit, lbs. per sq. in.	180,000
Tensile strength, lbs. per sq. in.	200,000
Elongation in 2 in.	8%
Reduction of area	25%

—THE ARMLEDER CO.

Edison Battery Performs Well on Tour

ORANGE, N. J.—Editor THE AUTOMOBILE:—A run was made recently to try the performance and availability of this type of car and the Edison battery through supposedly difficult country and over a route never before attempted by an electric car. And, being successful, to demonstrate to the residents of the sections passed through and to the members of the National Electric Light Assn. in convention at Burlington that the era of the electric roadster automobile has really arrived.

The route was from Boston to Fitchburg through Ashby, Jaffray, Dublin and Marlborough to Keene, N. H., thence in the evening through Walpole and Bellows Falls to Springfield, Vt. Next morning, via Walpole to Rutland, thence through Brandon, Middlebury, New Haven and Vergennes to Burlington, Vt. Total distance, 258 miles, including many detours of from 2 to 6 miles on account of road repairs.

The average speed for the whole distance covered was exactly 19 miles per hour. Total running time on the road was 13 hours and 35 minutes. The slowest run, from Keene, N. H., to Springfield, Vt., 42 miles, at 16.7 miles per hour, was made almost entirely after dark. The fastest section covered was from Boston to Fitchburg, 21.3 miles per hour. The 78 miles from Rutland to Burlington (including detours) was made at exactly 20 miles per hour. The hardest part of the route was from Springfield, Vt., to Rutland, fairly mountainous, with repeated descents to valleys and through several places of road repairs in process that could not be avoided by detours.

No adjustment or repairs of any kind were required or made on the way.

The car was a model E Bailey Roadster, equipped with 60 cells Edison battery, of the new A-5 size. It is not a special car, simply taken from service after having been run 10,700 miles during the last 11 months.

No attempt was made to run the car an extreme distance on one charge, such not being good touring practice and not necessary. The car was given a full normal charge before leaving Boston. No full charge was given the battery en route, but partial charges were taken at five different places—Fitchburg, Keene, Springfield, Rutland and Middlebury, at rates varying from 30 to 150 amperes. The normal charging rate of the battery is 37.5 amperes.—EDISON STORAGE BATTERY CO.

Batteries on Moon Car Show Endurance

ST. LOUIS, MO.—Editor THE AUTOMOBILE:—The endurance of the storage batteries used in connection with the Delco starting system which is a part of the standard equipment of the 1914 Moon cars, was demonstrated at a test at the factory of the Moon Motor Car Company recently, in which the starter spun the crank shaft for 25 minutes and after being allowed to recuperate for 10 minutes cranked for 3 minutes longer.

The maximum speed attained was 90 revolutions per minute, which Chief Engineer Heising, who conducted the test, says is more than sufficient to start the most stubborn engine in the coldest weather. Heising declared that very few persons can spin the crank shaft by hand as fast as that and then only for a few seconds, which is often not long enough in extreme weather.

The speed was well maintained through the period of the test, only dropping as low as 68 revolutions in the twenty-third minute.

The length of time that is required for the starter to get the engine going varies, Heising says, from a few seconds to several minutes, depending on weather conditions.

The batteries used are 6-volt storage batteries. They also furnish the electric lights for the car.—MOON MOTOR CAR CO.

Try Out Kerosene Carbureter

INDIANAPOLIS, IND., Editor THE AUTOMOBILE:—The Union Oil Co. of California recently challenged the Henderson distributing house in San Francisco to furnish a car with kerosene carbureter for their engineers to test, using sealed cans of kerosene and distillate to be supplied by their company. Chief Engineer Carlyle, of the Union Oil Co., in reporting the results of the test made the following statement:

Five-passenger car, 40 horsepower, four-cylinder engine, 4⅛ by 5½ inches. Average speed on trial 19 miles per hour, level roads. Engine was never out of gear. No coasting was allowed at any time during the test. Fuel used was engine distillate and kerosene of the commercial stock of the Union Oil Co. of California.

The test was made in the following manner. The feed pipe from tank to the carbureter was disconnected. A 1-gallon can of Union engine distillate was connected by rubber hose to the carbureter. The actual mileage on 1 gallon was 19.2. Union kerosene, under the same conditions, showed 20.4 miles.

At the present time interest in the fuel problem of the automobilist is so intense and widespread that tests of this character are of great value in demonstrating in what way and to what an extent economy can be secured.—HENDERSON MOTOR CAR CO.

Among the New Books

Works on Metallurgy, Electric Devices and Factory Methods Reviewed and Discussed

THE rapid advance of science in all directions is producing a heavy demand for the works of the scientific authors. The trade and technical papers are hard put to it, to keep up with the work in their various industries so, it is easy to realize the difficulties of securing up-to-the-minute information from the text books on any but the most stable subjects. The majority of these works are hot off the press and represent the latest developments in their various fields.

The works are on all subjects and the increasing growth in numbers of the technical text book is keeping pace with its increasing value in the methods of giving information. The books listed below are distinguished for their clear exposition of the subject matter—a contrast when compared to the cryptic language of the text book of the past decade.

Books dealing with the scientific management of factories and the art of applied electricity and metallurgy are much needed and the publishing houses have realized this demand as is evidenced by the great number of works on these subjects which are now being put before the public.

THE MOTOR AND THE DYNAMO, by James Loring Arnold, Ph. D., published by the Chemical Publishing Co., Easton, Pa., 178 pages, 6 by 9 inches, with 160 figures in the text. Cloth, price $2.00.

For the student of electrical engineering who wishes to begin at the mechanical principles and mathematical fundamentals of the dynamo and direct current motor this work should be satisfactory. In his introduction the author gives a few of the elementary rules of electro-magnetism, telling how the diffferent functions of the magnet and generator are performed. The method of determining the direction of induced current is also explained. The earlier chapters are devoted to the mathematical principles, an explanation of the dynamo machine and a study of the direct-current dynamo and motor. The remainder of the work is devoted to a study of alternating current, its measurement and the machinery designed to operate with it. Frequent examples are given and wherever possible clear mathematical explanations accompany descriptions.

GAS ENGINES AND PRODUCERS, by Lionel S. Marks, S. B., M. M. E., and Samuel S. Wyer, M. E. published by the American School of Correspondence, 210 pages, 5 by 8 inches, illustrated. Cloth, $1.00.

Parts I and II of this book are devoted to gas and oil engines. In these two parts the principles of the gas engine are taken up first from the standpoint of thermodynamics and then by a study of the cycle and the parts and accessories necessary in performing it. In Part II modifications of the Otto cycle, fuels and the larger types of gas engines are studied. Part III is devoted to gas producers. The introductory chapters dealing with gaseous fuels and their history and the remainder of the part devoted to the design of producers and the calculations necessary in determining heat balances, etc.

CALCULATIONS ON THE ENTROPY-TEMPERATURE CHART, by W. J. Crawford, D. Sc., published by J. B. Lippincott Co., Philadelphia, seventy-four pages, 5 by 7 inches with fifty-two illustrations. Cloth, $1.25.

Thermodynamics is a subject which seems to desert the student rapidly on his leaving school unless he is continually working with it. The use of the entropy chart may be applied to such advantage in steam engineering practice that a work of this kind should be welcomed by anyone who desires to make calculations necessary with steam engine or boiler design.

ELECTRIC FURNACES IN THE IRON AND STEEL INDUSTRY by Dipl. Ing. W. Rodenhauser, E. E., and I. Schoenawa, published by John Wiley & Sons, Inc., New York. 419 pages 6 by 9 inches, with 146 figures in the text. Cloth, $3.50.

With the increase in the use of electric steel castings and owing to the cheapness of manufacture electric furnaces are coming rapidly into more general use. The ability of the furnace to produce homogeneous tool steel free from gases is also claimed by the translater, C. H. Von Bauer to be a contributing cause to the success of the electric furnace. In this work all the successful types of furnace, including the arc furnaces, the Stassano, the Heroült, Girod, Kjellin, Rochling-Rodenhauser and many others, are discussed and a brief history of their development given. In Part II the design of the furnace and the constituents of the materials used in construction are studied. This work is of great value to the student of metallurgy and to the practical man who works in metals.

SHOP AND FOUNDRY MANAGEMENT, by Stuart Dean, published by *The Iron Age*, New York City. 220 pages, 6 by 9 inches, illustrated. Cloth, $2.50.

The elements of success in a factory have come to be so keenly realized during the past few years that it has become an absolute necessity for a firm wishing to continue in business to adopt the cost cutting methods which enable the product to be marketed in greater quantities with a minimum production cost. The series of articles numbering twenty which are given in this book are devoted to just such methods. The articles specifically deal with the shop and foundry but may be broadly applied to any business so far as the principles involved are concerned. It is a good book to read.

FACTORY LIGHTING, by Clarence E. Clewell, published by the McGraw-Hill Book Co., New York City. 161 pages, 6 by 9 inches, with 100 figures in the text. Cloth, $200.

Realizing the monetary return secured from an advantageously lighted factory this study has kept pace with other branches of factory improvement. The elimination of the shadow is of as great a practical importance as the proper air for the workman. Concentration of light on the work instead of having a large percentage of it in the eyes of the workmen is only one of the many points taken up by the author in this interesting work on an important subject.

IRON AND STEEL, by O. F. Hudson, and Guy D. Bengough, published by Constable & Co., Ltd., London, 173 pages, 5 by 9 inches, with forty-seven engravings. Cloth, 6 shillings.

Advances in metallurgy are so rapid these days that unless a text book is absolutely new it will hardly have kept pace with the advance in the art of using alloys. This work which has just appeared is not intended to be the last word in the science of combining metals but rather as an introductory text book to the subject. The processes of testing and the general rules and the practices of combining metals and of heat treating are given.

MACHINE CONSTRUCTION AND DRAWING, by A. E. Ingham, published by George Routledge & Sons, Ltd., London. 143 pages, 5 by 8 inches, illustrated. Cloth, 1 shilling, 6 pence.

This work shows the method of laying out a working drawing. It goes further than this in taking up the actual drawings for specific and often-used parts. The first chapter gives the method of laying out a drawing and explains the tools that are used. The remaining chapters are devoted to practical examples of mechanical drawings of important engine boiler and pump parts.

ELECTRIC BELLS, ANNUNCIATORS AND ALARMS, by Norman H. Schneider, published by Spon & Chamberlain, New York City. Eighty-three pages, 5 by 7 inches, with seventy figures. Cloth, 55 cents.

Perhaps the most common use to which electricity is put is in the operation of bells, announciators and alarms. No matter where you go the houses are wired for electric current and factories depend extensively upon it. In this little book full information regarding the wiring of small electrical devices, such as bells, is given.

Accessories for the Automobilist

BETTER Getter Economizer—Another electric vaporizer idea is exemplified in the Better Getter Gasoline Economizer Co.'s product, Fig. 7. It is very simple; just a piece of 1/8-inch pipe, which is inserted in the gasoline line and which has a small heating coil around it. The coil is well insulated and protected from the air by a heavy composition material. The battery leads are connected to the brass terminals shown at the right. A switch is provided on the vaporizer, but it is more convenient to operate the device from one on the dash, and this is what is generally done.

Four-in-One Heater — The heater shown in Fig. 1 is designed for either open or closed car use and is operated by using the waste heat of the exhaust gases. It consists of a heater valve that is placed in the exhaust line and which diverts some of the hot gases through the heating coils located in the car. Connection between the valve and the heater is through a large diameter flexible piece of tubing and the coils are suitably covered by a metal grating. The construction of the heater valve and the method of regulating the amount of heat is interesting. At the entrance to the pipe leading to the heater there is a rotating disk valve with ports in it that register with similar ones in the valve casing. Rotation of this disk is accomplished by a rotor that is operated by the exhaust gases impinging on its blades. When desired, two heaters can be operated from the one valve, a special branch connection being furnished for this purpose. Two heaters are generally used on open touring cars, one for the front seat and the other for the rear. The radiators can be located either in the car floor or in the seat panel under the seat. The installation of the valve is accomplished by cutting a section out of the exhaust pipe at any convenient place slipping the ends of the pipe into inlet and outlet nipples of the valve and tightening the set screws. This heater is the product of the Auto Heater Co. of America, 1148 Bedford avenue, Brooklyn, N. Y.

Duelec Primer—An interesting primer of the electrically heated type is shown in vertical section in Fig. 2. It is installed in the gasoline line and supplies hot gasoline vapor directly to the intake manifold by closing a switch. In the bottom of the primer there is a valve that is normally held closed by the coil spring above it, while on the upper end of the valve stem is an iron core. Surrounding this core and slightly below it is a combined solenoid and heating coil, which, when energized by closing the switch to the battery, magnetically draws the core down, and thus opens the valve. Then gasoline rises in the primer and is vaporized by the heat of the coil. When the motor is turned over this vapor is sucked into the manifold, and from thence into the cylinders, thereby supplying a good starting mixture. This device is made by U. S. Traub, 14 North Broadway, Yonkers, N. Y., and sells for $10.

Consolidated Heater—A small electric heater that does away with the necessity of draining the water from the radiator when the car is left in an unheated garage over night has recently been placed on the market by the Consolidated Car Heating Co., Singer Tower, New York City. This heater is placed on the top of the cylinders, the hood put down and the current switched on. Sufficient heat is generated by this device to keep the mechanism inside the bonnet warm, prevent freezing and make starting easy. The necessary current may be obtained from an ordinary lamp socket, and the cost of operation is 1 cent an hour. Alternating or direct current at 110 volts can be used. The price complete with cord and attaching plug, is $7.50.

Stalit Heating Plug—A simple electrical device, Fig. 4, that makes starting easy in cold weather by heating the mixture as it passes through the intake manifold is made by Geo. Statts & Co., 252 Lorimer street, Brooklyn, N. Y. It resembles a spark-plug in form and is installed by screwing it into the intake pipe. The heating effect is obtained by a suitable coil located in the end of the plug, and which is generally operated from a six-volt circuit, although plugs designed to run at other voltages may be had. The operation of the Stalit plug is simple; the current is switched on a minute or so before cranking the motor in order to give the plug a chance to warm up. When the engine is turned over the mixture is heated as it passes the plug, and thus a mixture is obtained that enables the motor to start on the first or second turn, even in the coldest weather.

Garrison Heater—The Garrison combined heater and muffler, Fig. 5, as its name implies, is a device for heating automobiles by means of the waste heat of the exhaust gases and serves equally well for open or closed cars. The heater fits into the floor of the car with only the foot plate showing and piping arrangements are such that any number of heaters can be installed. Regulation of temperature is effected through a three-way valve, which diverts more or less heat from the muffler to the heater. The foot-plate is the only exposed portion of the heater and is finished in nickel. This device is made by the Garrison Gasoline Engine Specialties Co.

Neverout Radiator Heater—With the

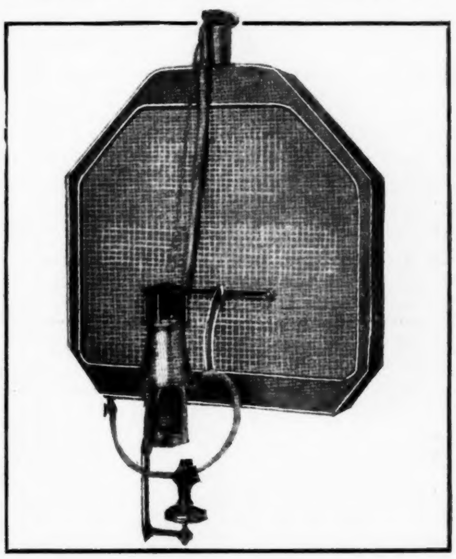


Fig. 6—Neverout radiator heater

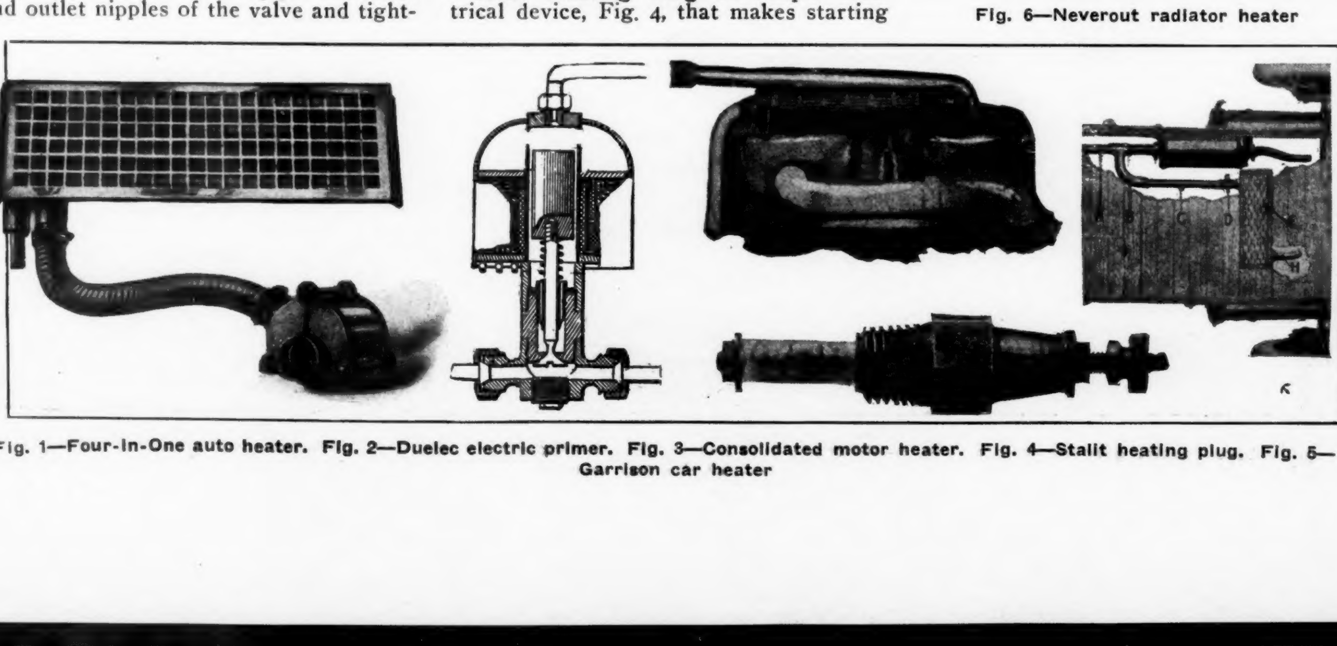


Fig. 1—Four-in-One auto heater. Fig. 2—Duelec electric primer. Fig. 3—Consolidated motor heater. Fig. 4—Stalit heating plug. Fig. 5—Garrison car heater

idea of obviating the danger of a freeze-up and at the same time make starting easy, without installing a complete garage heating system, the Rose Mfg. Co., 910 Arch street, Philadelphia, Pa., has designed the radiator heater shown in Fig. 6, and which can be quickly attached to the cooling system when the car comes in at night. It consists of a small hot-water heater, which is operated from the city gas supply; water circulation is automatically maintained. The hot water passes from burner up through a rubber tubing that terminates in a hooked tube that goes into the filler cap, and the return connection to the heater is had by means of a small rubber tube that is attached to the drain cock at the bottom of the radiator. Circulation is automatic because the heated water being lighter rises and the colder water rushes in to take its place from the bottom of the radiator. One advantage claimed for this device is that it will take the chill off of the garage as well as keep the water from freezing because the warm water in the radiator loses its heat to the surrounding air, and thus warms it. Fire risk is minimized by surrounding the flame by a safety screen, such as is used in a miner's lamp. Where gas is sold at the rate of $1 per thousand cubic feet the cost of operation is about .4 cents per hour.

Robinson Auto Heater—A hot-water heating system that is similar to the systems in such general use in houses comes from the plant of the Robinson Auto Heater Co., Milwaukee, Wis. It comprises a combined heater and muffler, Fig. 8, in addition to the regular muffler, and one or more radiators depending on the installation. Heating is accomplished by diverting the exhaust gases from the main muffler and passing them through the combination muffler and heater, where the gases give up some of their heat to the water. As in house installations, water is circulated by thermo-syphonic or natural means, no pump being used. The valve that controls the heat has three positions: off, half-way on and all the way on. In the latter position all the exhaust is directed through the heater. The only attention required by this installation is to add a little water occasionally. The radiators can be had in any size and are designed to fit along the car sides, thus taking up a minimum of space. A wide choice of finishes are given, extending all the way from a black rubber to full silver plate, the prices ranging from $100 to $175.

Radio Auto Heater—An exhaust heater, Fig. 9, of simple design is made by the Milwaukee Auto Specialty Co., 715 Chestnut street, Milwaukee, Wis. It is designed to be countersunk into the floor of the car and consists of a hollow casting with a 1-inch pipe opening at each end and inclosed in a sheet metal box which measures 14.5 by 5 by 3 inches. The top of the radiator has an ornamental, grilled, nickel-plated surface. The heat is regulated by a lever that actuates a three-way valve in the branch from the exhaust pipe.

Peerless Hot-Water Heater—Another idea is illustrated in the Peerless hot-water heater shown in Fig. 10. This heater is supplied with hot water from the cooling system of the motor by connecting supply and discharge pipes from the radiator to the corresponding cooling pipes running to the radiator. Thus the two systems may be said to be connected in parallel, the regular cooling pump providing circulation. When the thermo-syphon system of cooling is used the pipe connections are the same, but water circulation is by natural means. The heaters are made in two sizes, and the top surface can be furnished in nickel, brass or statuary bronze finish, at the option of the purchaser. Heat control is obtained by adjusting a valve located on the dash and which operates by throttling the flow. This device is made by the Peerless Radiator Co., Gibbs, Idaho, and retails at from $35 to $40, depending on whether a six or an eight-tube radiator is selected.

Lehman Heater—A special form of coal is used in the heater shown in Fig. 11. This heater is made in various sizes and styles and is offered at prices ranging from $1.75 to $10. As the heat comes from within in these heaters and is not derived from the exhaust or the cooling system, these foot warmers are easily portable and can be carried from one car to another. The fuel used is made up into briquettes and is introduced into the heater by putting it in the drawer, which is shown partly open in the illustration. To start the heater place the coal in a good fire until it is red hot throughout. Then remove from the fire and when the little red flames have died out place it in the drawer. The briquette will smoulder at a red heat until entirely consumed, which will take up to 12 hours, depending on the size of the fuel unit and the position of the dampers. In case it is desired to discontinue the heat before the coal is used up the fire can be quenched in water. This heater is made by Lehman Bros., 10 Bond street, New York City.

Samson Foot Warmer—The American Electric Co., State and Sixty-fourth streets, Chicago, Ill., maker of the Samson electric horn, has recently brought out a foot warmer which can be used in carriages, automobiles, or in the home, for that matter, if it is so desired. It is light and easily portable and possesses the advantage of having a fuel that can be put out and relit as many times as desired. The device is fireproof and the products of combustion are odorless. One filling of fuel will supply heat for about 6.5 hours. The warmer cannot be tipped over and is provided with a handle for convenient carrying.

Burlington Robes—A great variety of colors, materials, sizes and prices is to be had in the robes offered by the Burlington Blanket Co., Burlington, O. These robes are designed to give the maximum amount of comfort and warmth and possess many special features. One model designated as the Sho-fur robe has pockets for the feet, thus enabling the driver of the car to have unhampered use of the pedals and still be well wrapped up. Another type is called the Tonneau Mat robe, and is made to cover one or more people. The bottom edge has a large flap, which is intended to go under the feet, and thus keep the lower parts of the body well protected from the cold. Individual mat robes are intended especially for the folding seats, while the robes for two or three people are for the rear seat.

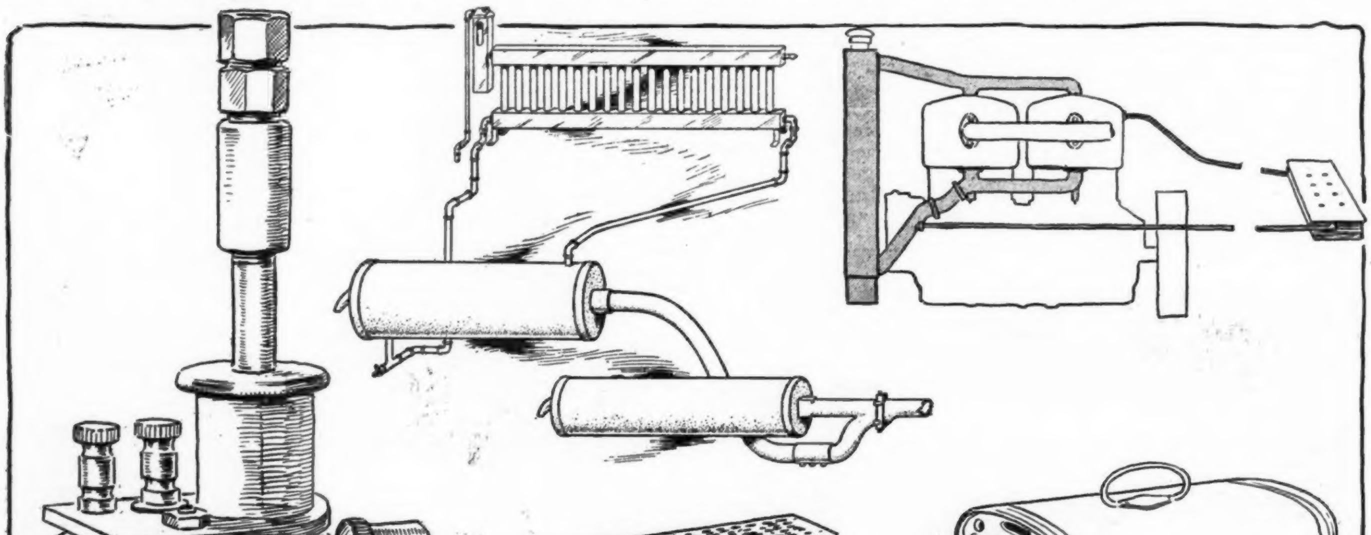


Fig. 7—Better getter gasoline primer. Fig. 8—Robinson auto heater. Fig. 9—Radio car heater. Fig. 10—Peerless hot-water heater. Fig. 11—Lehman foot warmer